THE ELECTRICAL WORLD

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The New Siemens Dynamo.

The variety of types and modifications of the dynamo-electric machine is so great that it seems as though but little new could be expected from inventors working in this field. For the last two or three years inventions have multiplied to an almost perplexing extent. The inventor who wishes to keep informed, in order to avoid repetitions of existing inventions, finds a laborious task in the analysis of what is constantly coming to the surface through the efforts of fellow inventors. It may be said, however, that very little new has been produced. Naturally, the inventor strives to create something different from what is already known, in the hope that it may be something superior to what exists. And so, details and forms have been changed successively, but a radical departure in principle from the prototypes of the dynamo-electric machine is rarely to be found.

In many cases it seems as though the inventor turned to new forms for the mere purpose of gratifying his desire to produce something novel, without inquiring whether the invention is progressive or retrogressive. One feels impelled to ask, what is the good of thus multiplying the styles and makes of dynamos, if, after all, we always have the same old Gramme or Siemens machine? The answer is that, though we may be ever so well satisfied that the principle has been sufficiently and even thoroughly grasped, still it is not certain that the best form of applying it has been produced. We must submit to this segregation of types and make experiments to get at the facts and characteristic points of each case. Electrical engineering is going through a period of probation, so far as the construction of dynamos is concerned. If we fail to discover any new points of utility in experimenting with this or that new dynamo, we shall at least find out what to avoid. The new machine of M. Siemens, which we here illustrate, will doubtless attract attention by reason of the fame of its inventor. It is of the class, however, that is more interesting on account of its novelty of construction than because of its merits, either as an invention or as a step toward efficiency. It is simply a Gramme machine, in which the ring armature is stationary and placed outside the field magnets instead of inside, as in the ordinary Gramme machine; and the field magnet itself revolves within the ring armature.

Fig. 1 shows a general view of the machine. The ring armature is wound in sections around an iron core, as in other ring armatures, the iron core being elongated so that the armature is wider or more cylindrical than the usual Gramme armature. The field magnet is shown partly in Fig. 2. It is nothing more than the H armature, known as the old Siemens' armature, which was used in the early types of machines, such as the Ladd, Wild and others. On the shaft carrying the field magnet there are two collars insulated from each other, one being connected with each end of the wire wound around the field magnet. The current which passes through the field magnet circuit is consequently never reversed, and the polarity of each pole of the field magnet remains constantly the same. As this field magnet revolves it follows that it acts upon the ring in exactly the same manner as if the ring itself rotated and the field magnet were stationary. Consequently, each section of the ring passes through a phase of induction lasting through half a revolution, during which the current is in a given direction, and then through another phase, during which the current is in the other direction, just as in the ordinary Gramme machine, the cause being the same. Each section is cutting lines of force of one polarity one-half of the revolution, and cutting lines of force of the opposite polarity the other half of the revolution. The sections of the armature are connected to a commutator in precisely the same manner as in the Gramme armature; and it is evident that the currents must be commutated just as well as when the ring is revolving. In this case, as the commutator cannot revolve, the brush holders themselves revolve. They are attached to the shaft of the field magnet, as shown at *B* in Fig. 1, and the brushes point outward, as represented, on the inside surface of the commutator segment. The idea of the contact taking place on the inside surface of the commutator is not new of itself, as it has been adopted in some modifications of the Gramme machine.

The brushes are adjusted to make contact with the commutator at points corresponding to the neutral portions of the ring. The neutral portions of the armature are constantly running around in the direction of rotation, following the magnetic poles and keeping behind by merely a quarter of a revolution. This machine being nothing more than a Gramme machine reversed, the question arises as to whether it possesses any special advantages. In the first place the mass of magnetic metal composing the magnetic field is very much reduced, and this of itself is a great disadvantage. For instance, if the machine is run with a low resistance in the external circuit, the amount of current circulating naturally increases. According to theory, the effect of this should be to make the magnetic field stronger, consequently to increase the inductive action on the armature; but when the mass of metal in the field magnet is insufficient, the increase of current does not produce or proportionately increase the magnetism. In some cases the point of "saturation" is reached very soon, and any further increase of current produces no corresponding increase of the magnetism. On the other hand, the more the current increases in the circuit, the more the reactive

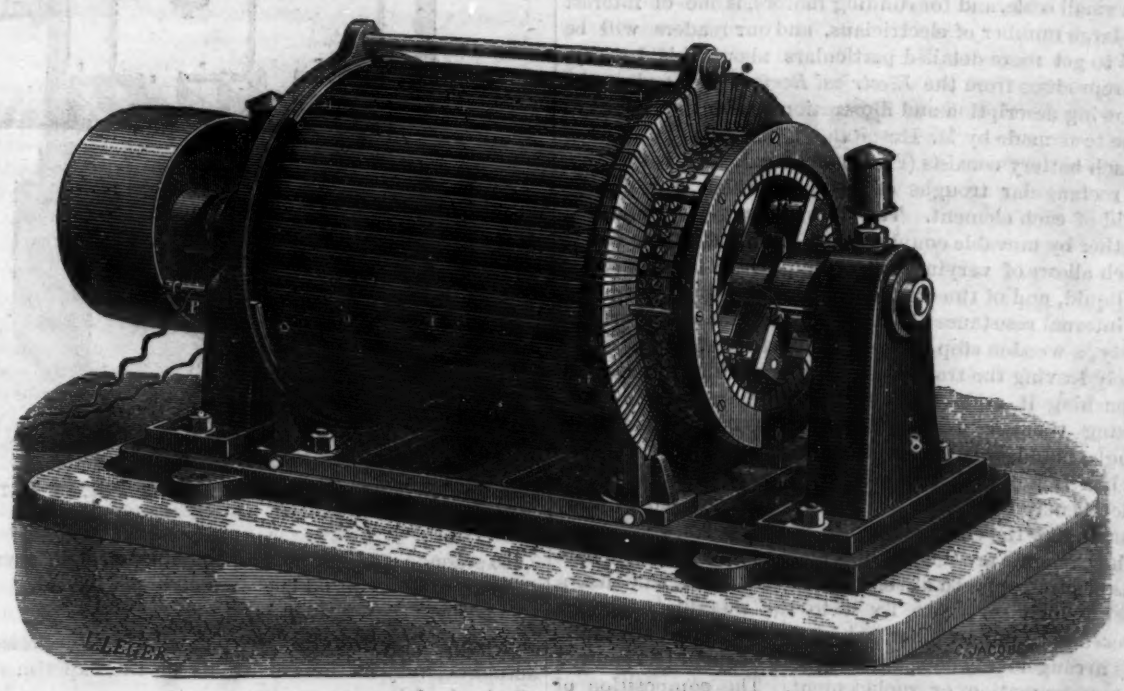


FIG 1.—THE NEW SIEMENS DYNAMO.

effect of the armature core increases, as the current which circulates in the armature tends to magnetize the armature core, just the same as any ordinary electro-magnet. The reaction of the ring is much greater in such cases than the power of the field magnet; and the swering or displacing effect in the field is greater. In other words, the lines of force in the field magnet become displaced. They are inclined so as to cut the sections of the Gramme ring more obliquely. The consequence is that for the same speed the electro-motive force will not be so great; besides, the displacement of the brushes should then be greater, and as there is no way of adjusting or displacing the brushes in order to give them "lead," the variations of current which follow the changes of speed cannot be compensated by adjusting the brushes, without stopping the machine. When the magnetic mass of the field is greater the point of saturation is reached much later. The stronger reactive effect of the armature which follows the increase of current when the resistance is diminished, is much less. The deflection of the field of force is less marked, and the displacement of the brushes, or the lead necessary to compensate for these fluctuations, is very much less. The chief disadvantage under which this machine labors is that the close approach of the field magnet to the armature wire is attended with greater inconvenience. We all know how difficult it is to lay the wire of the Gramme armature. It is almost a matter of absolute impossibility to pack the wires inside the ring so as to make the inside circumference perfectly symmetrical and concentric; consequently it would be a matter of great difficulty to revolve the field magnet poles as close to the interior surface of the armature as it is possible to revolve the exterior surface of the armature to the field magnets in the ordinary machine. There is only one advantage in this form of arrangement. The polar expansions of the field magnet would serve to hold the field wire in, and the result would be that the tendency to burst by centrifugal force would be very much lessened, particularly if the wire coils are bound, as is usually done.

Another important question which arises is in regard to the comparative extent to which the wire composing each section of the ring becomes useful in cutting lines of force. It is doubtful whether any of the wire outside the ring serves to cut lines of force. In this machine, even admitting the theory of "interversions of polarity," advanced by M. du Moncel, it is not easy to see how that portion of the wire can be of benefit. In the ordinary Gramme machine there is no question as to the utility of the outside wire as a factor in the results; and there can be no doubt that a considerable portion of the wire inside the ring also contributes to the useful results. It would be interesting to have comparisons made between these two machines for the purpose of determining whether there is any absolute advantage in some points of the peculiar construction of this machine. At first sight it does not appear to be an improvement, and we are under the impression that when studied experimentally, so as to resolve its "characteristic curve" in the manner described by M. Deprez, it would show at once the disadvantages which must result from the presence of so little iron in the inductive field. However, it is possible that there may be food for reflection in this machine. The question of the transmission of power to a distance is now assuming great importance. We are called upon to consider the possibilities of dynamo-electric machines as receivers as well as generators of electrical energy; that is to say, as motors at the distal ends of lines, whither it becomes convenient to transport power.

The disadvantage of the dynamo-electric machine of the ordinary form, when used as a motor, depends on the fact that it gives rise to a counter electromotive force. When the armature is made to revolve—either by an extraneous current or by application of mechanical force—the sections of wire are in a magnetic field, and by their motion cut lines of force so as to give rise to an electromotive force inevitably in such a direction that its magnetic power tends to oppose the motion which brought it about, this opposition being nothing more than the consequence of Lenz's law. By diminishing the length of wire subjected to action in a magnetic field, it follows that the counter electromotive force evolved will be smaller

and by diminishing the amount of magnetic metal the reaction which this electromotive force can produce will be diminished still more. Therefore, it appears reasonable to suppose that in a machine of this class the arrangements are more suitable to its application as a motor than as a generator. The amount of self-induction produced is not likely to be as great, and the diminution of the electromotive force of transmission by the reaction of the motor is not likely to be as large.

The idea of applying this form of construction to electromotors has been already seized by Professors Ayrton and

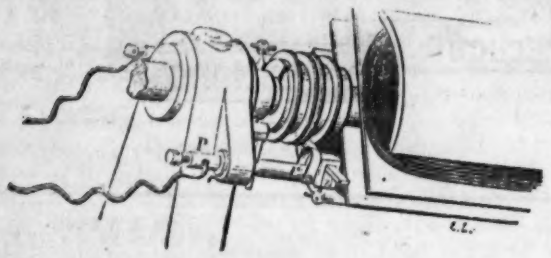


FIG. 2.

Perry in the construction of a motor, described in Prof. Ayrton's lecture on "Electric Lighting and Locomotion," in THE ELECTRICAL WORLD of March 24, page 182, which resembles this machine in all essential particulars, and was doubtless derived from it, the main difference being that the outside ring has the form of a Pacinotti armature with the iron projecting between each section. The working of the motor is said to be excellent, and the efficiency claimed for it by its inventors is great, for the reasons enumerated. We would be pleased to learn of comparative tests of the new Siemens machine, both as a generator and as a motor. Undoubtedly the particulars of such tests would be of much value to electricians.

The Bichromate of Potash Battery of M. Trouve.

The improved battery of M. Trouvé has attracted considerable attention from scientists since it has proven successful in supplying incandescent lamps. In *The Operator* of May 1, we gave an account of the use of this battery at the general meeting of the French Physical Society, and added some details regarding its peculiarities.

The question of using voltaic currents in electric lighting on a small scale, and for running motors, is one of interest to a large number of electricians, and our readers will be glad to get more detailed particulars about this battery. We reproduce from the *Electrical Review* of London the following description and illustrations, with an account of some tests made by M. Hospitalier:

Each battery consists (Fig. 1) of an oak box, containing six rectangular troughs of ebonite, which contain the liquid of each element. The zincs and carbons, connected together by movable couplings, are mounted upon a frame which allows of varying, at pleasure, their immersion in the liquid, and of thus regulating the delivery by altering the internal resistance of the battery and its active surface. Lastly, a wooden stop prevents the elements from completely leaving the troughs; but by removing this stop or by pushing it aside the height of the frame allows of making them quite independent, so that the ebonite troughs may be readily emptied or refilled. The front of the box is provided, for this purpose, with a hinge, by which it may be opened and the troughs removed without disarranging the elements.

The elements are formed of a plate of zinc and two carbons electro-coppered at the upper part. The zinc has a notch which serves to fix it to the metallic couplings covered with india-rubber, which support the elements. This arrangement enables the zincs to be quickly removed for amalgamation or replacement. The composition of the liquid for a battery of six elements is as follows:

Water	8	Kilogrammes.
Pulverized bichromate of potash	1.2	"
Sulphuric acid	3.6	"
Total	12.8	"

The solution contains, therefore, 150 grammes of bichromate of potash per litre of water, instead of 100 grammes, as in the formula given by Poggendorff.

For a more rapid delivery, M. Trouvé increases the quantity of bichromate and dissolves from 200 to 250 grammes per litre of water.

This is how he prepares the solution:

He throws into the water powdered bichromate of potash at the rate of 150 grammes per litre of water; after having agitated it, he adds by means of a fine strainer, and very slowly, 450 grammes of sulphuric acid per litre, or a quarter in volume; the liquid mixture heats little by little, and the bichromate once dissolved remains limpid and does not deposit by crystallization on cooling. The preparation takes eight to ten minutes. Care must be taken not to use a wooden agitator, as this would be rapidly carbonized, uselessly weakening the solution.

The medium weight of a battery of six elements is thus divided:

6 zincs	7.680	kilogrammes
12 carbons	5.460	"
6 ebonite troughs	1.620	"
Contacts	0 600	"
Oak box	3.000	"
Iron standards	2.300	"
Liquid	12.800	"
Total weight	33.460	"

or 67 kilogrammes for the two batteries.

RESULTS OF EXPERIMENTS.

The 12 elements connected in series were discharged through six Swan lamps in derivation. The delivery was regulated by manipulating the frame of each battery so as to maintain a constant current of eight ampères during four hours and a half. At the moment of immersion the great initial electromotive force of each element produced a current of 12 ampères, although the zincs were only plunged in about two centimetres. After a few minutes the current returned to its normal strength of eight ampères. The slight heating of the liquid then caused a slight increase of consumption, which became normal 15 minutes after the starting. The battery worked in these conditions for an hour and a half without necessitating the lowering of the zincs. From this moment the decreasing delivery was compensated by gradually increasing the immersed surface. The variation never exceeded half an ampère, and the mean current was very carefully kept at eight ampères during four hours and a half, after which time the zincs were completely immersed to a depth of about 15 centimetres in each element. From this time the decrease was very regular and the experiment stopped by raising the zincs when the current had reached five ampères. (See discharge curve, Fig. 2.)

The discharge was, therefore, divided into two phases:

1st Phase. The delivery maintained constant at eight ampères during four hours and a quarter.

2d Phase. The delivery decreasing regularly from eight to five ampères during one hour and twenty-five minutes.

1. *Constant Phase.*

Difference of potential at terminals of lamp	14.15	volts
" " " batteries	16.70	"
Intensity of current	8	ampères
Disposable electric energy in external circuit	133.6	watts
" " "	13.5	kilos. per second
Duration of constant phase	15,300	seconds
Quantity of electricity furnished	122,400	coulombs
Total disposable electric energy in external circuit	206,550	kilos.

2. *Decreasing Phase.*

During this second phase the mean current was 6.55 ampères during one hour and twenty-five minutes, or

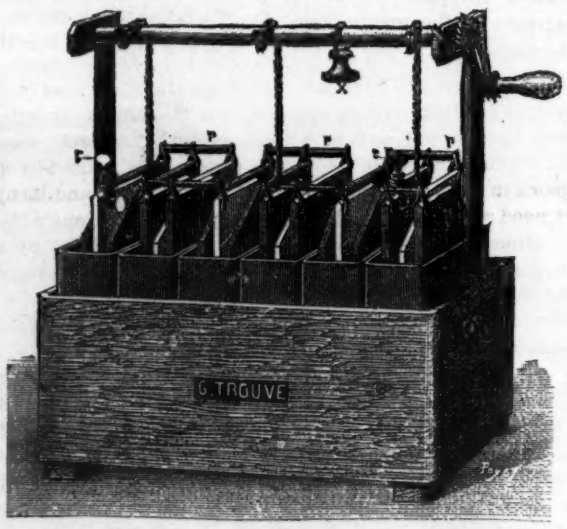


FIG. 1.—M. TROUVÉ'S BICHROMATE OF POTASH BATTERY.

5,100 seconds, and the mean disposable electric energy in the external circuit 9 kilogrammetres per second.

Total Work.

When we totalize the two phases which represent the actual delivery in the conditions of the experiment, we obtain the following results:

Total quantity of electricicty furnished, 156,000 coulombs.

Total disposable energy in the external circuit 253,350 kilogrammetres.

The H. P.-hour or 1,980,000 foot-pounds being equal to 270,000 kilogrammetres, these figures show that the two batteries furnished together 0.96 H. P.-hours, or practically ½ H. P.-hour per battery of 6 elements.

Five batteries of 6 elements, that is to say 30 elements in series, would suffice to supply an arc lamp burning carbons 9 millimetres in diameter, with a current of 7 ampères and 40 volts difference of potential at the terminals of the lamp during five hours.

Consumption of Zinc.—The zincs weighed before and after the experiment indicated a consumption of:

For the first battery	751	grammes
" " second "	712	"
Total	1,463	"

or on an average of 123 grammes per element. The minimum consumption was 105 grammes and the maximum consumption 133 grammes. The theoretical consumption, deduced from the quantity of electricity and the electrochemical equivalents is 53 grammes per element, or 636 grammes for the two batteries.

It follows from these experiments that two batteries of 6 elements each, newly charged, represent a disposable electric energy of 1 H. P.-hour or 270,000 kilogrammetres, with a weight of not more than 67 kilogrammes. It is important to notice here that no arrangement has been made from the point of view of lightness, and that it would be easy to reduce this weight to 50 kilogrammes. This figure is said to be lower than accumulators have been able to furnish up to the present time.

The consumption is represented by the following figures:

Zinc	1,460	grammes.
Bichromate	2,400	"
Sulphuric acid	7,200	"

These figures allow of calculating easily what is the price per H. P.-hour of disposable electric energy with

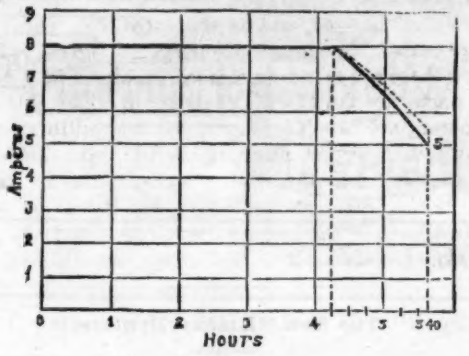


FIG. 2.

M. Trouvé's batteries when we place them in the usual conditions of delivery, of which the results are given above.

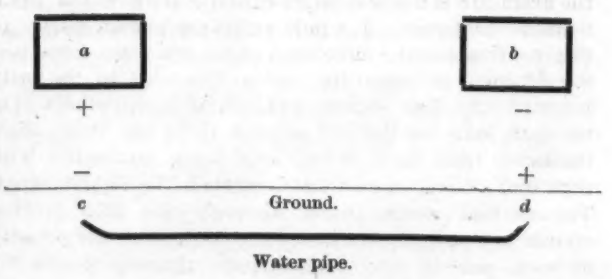
Lightning's Queer Freaks.

The following item from a Pennsylvania journal is sent us by a subscriber, who desires our opinion as to the probable truth of the statement it contains:

"Lightning burst out at the foot of a Wilkesbarre hill the other day. The electricity ran along some water-pipes under ground for some 2,000 feet, entered the cellar of a house and escaped by way of the chimney."

This is not the first time that the reputation of lightning for consistency has been impugned. It has a long-established renown for eccentric and erratic behavior, which has almost become proverbial. On general principles, we would be ready to believe a pretty tough story about lightning's freaks, but the above makes us hesitate, because, notwithstanding that it is so untractable, lightning does, nevertheless, come under certain laws which it must obey.

Electricity, of any form soever, is set in motion only when a difference of potential exists between the two ends of its path. The transfer of electricity which then takes place is only an effort to restore equilibrium. When a flash of lightning leaps from the storm cloud to the earth it is because a difference of potential exists which tends to urge the transfer of a certain amount of electricity from the one to the other. If the earth has the higher potential the electricity moves to the cloud; if the cloud is the seat of higher potential, the electricity moves to the earth. There is no doubt that some lightning discharges start from the earth as well as from the clouds. The fiery streak spans the space so quickly that we cannot tell which way it is moving, and so far as the effects are concerned they would be the same, no matter in which direction the electricity passed. Now, the important point in the present case is this: If the seat of higher potential is the cloud, then there is a tendency to the discharge of current from above downward, but not from below upward. Therefore, the escape of lightning upward through the chimney looks rather paradoxical, considered from this point of view. There is only one hypothesis on which we can explain it. Referring to the following diagram



we might suppose the existence of two clouds *a b*, situated at a distance from each other and charged with different electricities which would act inductively on the neighboring surface of the earth below and condense electricities of opposite kinds (—, +). Now it is well known that when a conductor is subjected to inductive (static) influence its opposite electricities are dissociated. The water pipe, therefore, forms a handy means of increasing the tension at the two points, for it transfers all of the negative electricity around *d* to the space around *c*, and all the positive electricity around *c* to the space around *d*. In this case the condition may be expressed by saying that in one cloud *a* the potential is higher than that of the earth and tends to send electricity to the earth, while in the other cloud the potential is lower than that of the earth and the electricity tends to move upward.

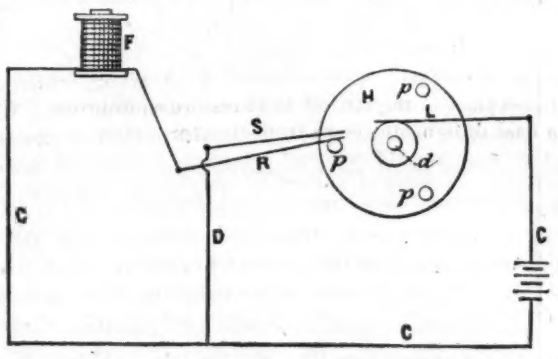
There is also a tendency to transfer current from the high potential *a* to the low potential *b*, directly, by a flash between the two clouds, an occurrence which is quite frequent in thunder storms. Moreover, on looking at the diagram,

it will seem evident that there is a tendency to a transfer of current through the ground or the pipe from *d* to *c*. Now, let us suppose that the potential rises to such an excess at *a* that a flash occurs to the earth and produces a partial equilibrium at *c*. The moment the discharge takes place the potential at *a* lowers, and the tendency of this cloud to send electricity to *b* is smaller, because it is more nearly of the same low potential. Again, the potential at *c* has been raised by the discharge, so that it is more nearly equal to that at *d*. But the potentials at *b* and *d* have not themselves changed, and as the other two paths of discharge cease to invite any discharge, to a great extent, the tension between *b* and *d* becomes greater, and a discharge from earth to cloud will likely occur. In this manner the potentials become neutralized or equilibrated. Presumably this second discharge would take place almost immediately after the first. Perhaps this is what happened in the instance cited above, but it will be seen that the electricity of the second discharge could not properly be considered the same as that of the first discharge.

M. Spellier's Circuit Breaker for Electric Clocks.

In transmitting impulses of current along a line for operating or regulating clocks and other similar apparatus, the occurrence of sparks at the circuit-breaker is a source of trouble, because it causes the contact points to wear out unevenly, and to make the impulses more irregular and uncertain. This difficulty has been the chief source of trouble in time systems, and hitherto no ready expedient has been at hand to obviate it. The sparks, as is well known, result from the self-induction which take place in the circuit, more particularly in the electro-magnets, these currents being called "extra currents." In the system of the Time Telegraph Company, described in our last issue, we saw that the undesirable effects of these extra currents were obviated by a simple expedient, which consists in using a shunt circuit of considerable resistance, through which the current divides during the lattter half of each impulse, and through which the extra current discharges itself when the circuit is interrupted.

M. Spellier, in France, has also suggested a means of eliminating the extra currents, which is on the same principle, though simpler if anything. The following diagram



shows the manner in which the idea is carried out. Only one dial magnet *F* is represented. The metallic wheel *H* of the regulating clock receives the current through a flat spring *L* pressing on the axis *d*. This wheel carries three projecting pins *p p p* on its side, which serve to make the contacts. The wire from the other end of the circuit is connected to a flat spring *R*. As the wheel turns one of the pins *p* comes into contact with the end of the spring *R*, and thus the circuit is closed and the magnet *F* made active. If the pin *p* were to leave contact with the spring *R* the extra current would give rise to a spark at the point of contact. To avoid this, another flat spring *S* is placed directly above *R* and connected by a branch line *D* to the other side of the dial circuit, as shown in the diagram. As the wheel turns, the springs *S R* are brought into contact. The battery is short-circuited through *P* and all the electro-magnets are also short-circuited, so that their extra-current can discharge itself through the branch *D*. When the pin *p* escapes, the springs are still in contact; they remain so for a brief instant, before they fall back by their elasticity, and therefore keep the extra current short circuited until the pin *p* has opened the battery or main circuit.

The only objection which we can see to this method is that it does not prevent the spark or the small voltaic arc which must result when the battery current itself is broken, as will be evident on examining the diagram.

However, when the current used is not very powerful, this would not be a serious objection. The extra currents are far more troublesome and noxious. This ingenious idea may be valuable as a suggestion in many cases where interrupted currents are used, and where the extra induction is the most important thing to be attended to.

The Electrical Photophore.

The inventive genius of Mons. G. Trouvé, so fertile in the production of electrical novelties, has lately contributed another of the interesting as well as useful applications of electricity for which his name has become so justly celebrated.

It is well known that some three years ago, when the incandescent light was first brought to public attention M. Trouvé conceived the happy idea of applying it to medical purposes in the exploration of the mouth, throat and other internal cavities of the human body by the invention of his diascope, which enabled the physician to dispense with the inconvenient reflectors that were necessary in physical diagnosis.

The present achievement of M. Trouvé tends to the application of the incandescent light to similar purposes. In exploring the nose, examining the teeth or in ophthalmological examinations, it is convenient to have a source of light which can be manipulated by the surgeon without any great inconvenience. Heretofore the surgeon has resorted to the use of the frontal reflector, whose concave surface

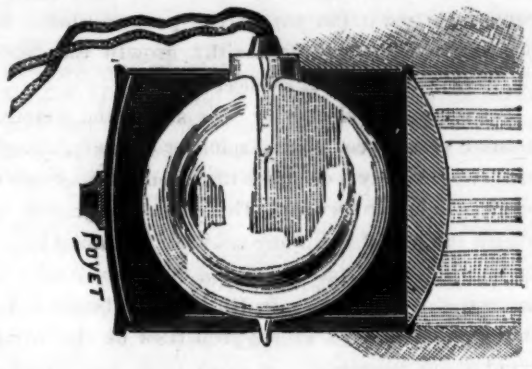


FIG. 1.—THE ELECTRIC PHOTOPHORE.

converged the rays of a lamp placed near him to a focus situated at the point of examination, or at a convenient distance.

Instead of this M. Trouvé proposes to substitute a small incandescent light. In connection with Dr. Paul Hélot, chief surgeon of the hospitals at Rouen, France, M. Trouvé has produced an invention which is an adequate substitute for the reflector. Fig. 1 shows the arrangement in part section. It is composed of an opera glass cylinder or tube in which a small incandescent lamp is fixed. The bottom of the cylinder is provided with a suitable reflector in the form of a concave mirror, while a plano-convex lens at the front part serves to control the size of the beam of light projected. The figure represents the apparatus in full size, the cylinder being open to show the lamp. It will be seen that it suggests a miniature dark lantern. Fig. 2 shows the manner in which the photophore is used by surgeons in exploring the cavities of the ear, nose and larnyx. It need scarcely be said that the apparatus is susceptible of other uses besides those to which it can be put by the surgeon. Among others, dentists will find it a convenient aid in their work. The incandescent lamp is fed by a bichromate of potash battery lately perfected by M. Trouvé, only a small number of cells being required.

Many dental surgeons in Europe are already making use of the small electrical motor of M. Trouvé in operating their lathes and dental engines, consequently they have at hand the source of current necessary for supplying the light. A small switch worked by the foot could doubtless be devised so that the battery current could be transferred at will from the photophore to the dental engine.

We remember reading some time ago of the inquiry made by a musician to an electrical journal regarding the means of obtaining a small light sufficiently portable to be attached to the military cap used by the brass band organizations, for giving light to read music by in processions taking place during the evening. The necessity of a light that will enable a musician to read the music to be played

FIG. 2.

is apparent, though heretofore nothing has been provided save the unsightly torch. It is not impossible that a battery small enough to be comfortably carried by the performer can be made, so that each musician will be enabled to carry his own light.

There are also many other applications where it is likely to be introduced, some of which will suggest themselves to our readers. The invention goes to show how easily sometimes a useful convenience may be obtained. There are many more of these little things where electricity can be brought into play readily and beautifully, in spite of the fact that M. Trouvé has already attended to several.

An Electric Photographer Interviewed.

We made brief mention last week of a New York photographer's success in photographing the interior of the Madison Square Theatre at midnight. The stage was set with the pretty cottage scene in the first act of "A Russian Honeymoon," and all the actors in the play were grouped thereon. Clear and beautiful pictures of the scene were taken in four seconds. Mr. Falk was the photographer who accomplished this interesting piece of work. A reporter of the New York *Tribune* called on Mr. Falk, in his gallery on Broadway, a few days ago, and opened a dialogue on the possibilities of photography by electric illumination in the future:

"I tell you," said Mr. Falk, "this is the dawn of a new era in photography. Taking photographs by the electric light is going to knock the old plan higher than a kite. Who ever thought such a thing could be done ten years ago? I've been trying it for some time, but never happened to hit it just right until the other night at the Madison Square Theatre. The tableau at the end of the second scene of the 'Russian Honeymoon,' is a capital thing to take, there are so many actors on the stage, and the setting of the scenes and the bric-a-brac led me to think some time ago that I couldn't get a better subject to experiment on. Well, I made two trials before the last one. The first time I had nine electric lights and the second time twenty-four But there wasn't enough light, so I failed. Last week, however, we arranged to have all the light we wanted, and at the close of the play one night we took three cameras and the necessary paraphernalia, and went to the theatre. The Brush Electric Light Company offered the use of these lights, and Mr. Frohman, the manager of the theatre offered to pay the expenses of having the lights put in position. The work began at 11 o'clock. About twenty-five lights were suspended from the flies so that they hung directly back of the curtain, and were so arranged that they were not seen when the curtain was rolled up to its limit. There were four other lights in the auditorium suspended from the balcony, each light having a large piece of tin back of it to throw the light on to the stage. In the rear of the scene, just outside the big window, which, you remember, is in the back scene, we hung four other lights. There were several lights also in the wings of the stage. In all, there were thirty large lights, such as are used in lighting the streets. The electricity was brought in from the street, and when it was turned on there was a noticeable dimness in the lights in the street; but it was only for a few minutes. The lights having been adjusted and set to burning, we arranged our three cameras and were ready. The performers came on to the stage and took their positions. At one o'clock the first picture was taken. We took eleven in all, two of which were not good, as some of the performers moved. But the rest are capital," and Mr. Falk showed a copy of them to the reporter.

"You will notice," said the photographer, "that everything is as clear and distinct on the stage as it can be. The faces, the features, in fact everything, stand out in fine style. I showed this picture to another photographer, and he asked me if it was a copy of an oil painting. He couldn't believe it was taken from life."

"Has the thing ever been tried before?"

"Yes, once in Boston and once in London about six months ago. Both the attempts were crude. You see this will be a fine thing for the London photographers when it is finally developed. It will not make any difference to them then whether the fog is thick or not. They can make their own light. It will, on that account, be be much more valuable to them than to us. We have a great deal of good weather, you know, and can get all the sunlight necessary. We look on stormy or cloudy days as a sort of holiday and take our rest then."

"Does the process differ materially from the ordinary method of photographing?"

"No, it's the same thing. The only difference is that for electric light photographing we use very sensitive plates—that's all. The plate is developed by the most sensitive developers known to the art. The difficulties which we have had to encounter always were, first, the trouble in getting so much light on the stage without hurting the eyes of the persons on it; second, the difficulty in measuring for artistic arrangement such an immense quantity of light. We hope to make these pictures look like an oil painting. And it will be done. This picture is nearly perfect. You see the great object is to take life scenes. It's all easy enough to make a picture by electric light where there is no life. But in a thing like this where there are a great many persons to be photographed, you can't keep them still any great length of time. That's the point."

"How long were you in taking the picture the other night?"

"Well, the first picture was taken in eight seconds; that was a small one. The largest one required eighteen seconds. This electric light photography is going to revolutionize the whole system of theatre-advertising. They'll have lithographs of the most striking scenes of the plays, and will use them instead of the bills now in use. And what a great advantage it will be to the people who go to the theatre. As it is nowadays, the scenes and incidents of a play live only in memory. The great actors, like Kean, Booth, Garrick, Barrett, and the rest of them, all die or leave the stage, and we have nothing but the memory to help us replace them in their great plays. By this new process we can have them constantly before us in character, dress, scene, situation, and everything, all complete. I tell you it's a grand thought. Single persons have had their pictures taken in this way; but this is the first time that a group of people have been successfully photographed by this process."

THE
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CONTENTS.

ILLUSTRATED ARTICLES: PAGE
The New Siemens Dynamo....305
The Bichromate of Potash Battery of M. Trouve....306
Lightning's Queer Freaks....306
The Electric Photophore....307
M. Spellier's Circuit Breaker for Electric Clocks....307
Microphonic Contacts....310
Electric Lighting XXVI....311
MISCELLANEOUS:
An Electric Photographer Interviewed....307
Registering Policemen by Electricity....312
Pittsburgh Telephone Notes....312
Underground Stockholder's Meeting....312
The Electric Light in California....312
An American Electrician Abroad....312
EDITORIAL:
Electrical Schools....308
Electric Storms....309
The Electrical Voting Apparatus....309
Lightning in Telephone Exchanges....309
Death of an American Electrician....309
A Suggestion about Working Induction Coils....309
DEPARTMENTS:
Department of Inquiries....312
The Telegraph....313
The Telephone....313
The Electric Light....313
Miscellaneous Notes....314
Electrical Patents Issued....314
Business Notices....314

NEW ADVERTISEMENTS.

PAGE.
N. W. Lillie—Mutual District Messenger Stock For Sale....315
Hearne & Co.—Soper's Instantaneous Guide to the Piano and Organ....315
Peck & Snyder—Superior Fishing Tackle....315
Home Magnet Publishing Co.—A Valuable Present Given Away....315
Jay Reynolds—Downs Pencil Sharpener and Point Protector....315
Jos. J. Walton—Earth Closets....316
Tropical American Telephone Co. (Limited)—Bell Telephones, Blake Transmitters, Patented Telephonic Apparatus and Supplies for Export....316
H. C. Wilkinson & Co.—An Entire Printing Office for 75 cents....316
World Manufacturing Co.—Cheapest Book in the World....316
Bijou Photograph Co.—Photographs for one cent Each....317
Jerome Redding & Co.—"Gem" Instruments....317
The Brush Electric Co.—Arc Lights....318
The American Electric Storage Co.—Rights and Concessions to Subsidary Companies For Sale....320
RE-ARRANGED ADVERTISEMENTS.
Keuffel & Esser—Drawing Materials....315
George R. Fuller—Artificial Legs and Arms, Crutches....320

NOTICE.

We are sending copies of the May 15 issue of *The Operator* to each subscriber of THE ELECTRICAL WORLD. The two papers, as we stated before, will be kept entirely independent of each other, and there is enough matter coming within the province of each to make both interesting and valuable to all classes of electrical readers; at any rate, the expense of *The Operator*—50 cents until the end of the year—will not require much of a sacrifice on the part of subscribers, and by that time they will be better able to judge as to the wisdom of continuing it. By remitting the 50 cents now, your subscription for *The Operator* will be promptly entered.

Subscribers to both THE ELECTRICAL WORLD and *The Operator* will receive two copies of the May 15 issue of *The Operator*. They will oblige us by using the extra copy to what advantage they can in drawing the attention of non-subscribers to the papers, and, if possible, get us a few subscriptions for either or both. Any assistance our friends can render us, in the way of bringing THE ELECTRICAL WORLD or *The Operator* before those not already subscribers will be appreciated. Extra copies of either, circulars, etc., mailed free on application.

We are also mailing copies of both THE ELECTRICAL WORLD and *The Operator* to a number of non-subscribers as samples. To such we would say that we aim to make both papers strictly first-class in their own way, and that we shall appreciate any assistance they may be able to render us in the way of subscribing for one or both journals, drawing the attention of such as may not have seen them to the papers, or furnishing us for publication such items of information as they think would interest our readers. To induce all to give one or both papers a trial, we offer to send a copy of

THE ELECTRICAL WORLD (weekly) from the present time until the last issue in 1883 for....$1.00
The Operator for the same period for....50
Or both papers....$1.50

This includes postage to any part of the United States or Canada and the changing of addresses as often as desired. Those not already subscribers are asked to try one or both papers until the end of the year at the above special rate. We feel confident they will not regret doing so. Address W. J. Johnston, Publisher, No. 9 Murray street, New York.

ELECTRICAL SCHOOLS.

A few years ago the project of establishing a special school for teaching electrical science, and for giving practical training in the industrial applications which have been derived from it, would have been ridiculed as premature and unnecessary. To-day it is looked upon with interest by electricians and entertained with more or less universal favor by the public. This sudden change of opinion is certainly an interesting circumstance. It proves that if the want of better educational facilities in the science has not been a "long felt" one, it is none the less perceptible and important at the present time. It is a pleasing indication of the healthy growth that promotes the development of our science.

Ten years ago, electricity was still in the remote background of science, as a suspicious mystery, a neglected curiosity. To-day it occupies the foremost rank as a useful agent, a valuable servant. This rapid progress is unparalleled in the history of any science. It cannot be a cause for wonder, then, that we should have so suddenly realized a desire, a necessity, in truth, for a better and more thorough knowledge of the properties of the wonderful agent at our command. In every nook and corner of our industries, electricity is coming to the surface and suggesting itself as a dutiful assistant, a factor of convenience, if not of economy; but it fails to find there a competent guide to teach it its proper functions and to control it in the performance of its duties. The fact is that electrical science is conquering new territory faster than it can occupy it. It needs reinforcements—not raw recruits, but trained veterans—skillful, competent electricians.

The question of founding electrical schools or of establishing electrical "departments" in the universities is one that cannot but interest electrical men as a class. It is full of reflections and suggestions. That better facilities of this class are really needed, nobody will deny. It is here in America, especially, where the lack of competent electricians is particularly felt. We are the most enterprising, the most inventive nation. We have taken to electricity more kindly, more generally, than the other nations. We are trying harder to develop its capabilities, and yet we are the very nation that knows the least about it. It is not saying too much to state that, even among our best electricians in this country, the standard of electrical knowledge is much lower than in Europe. The American electrician is literally obliged to go abroad in search of the very principles which he seeks to utilize. In other words, he has to take lessons from such men as Siemens, Deprez, du Moncel, Thomson, Maxwell, Jenkin and a host of others nearly as eminent in the science, because there are no such teachers at home.

If we propose to be as independent in this science as in other things, and to do our own thinking, it is high time that we should begin to gather the material for producing able thinkers.

The American electrician rather likes to boast that he is practical. He scorns the insinuation of theory. But it is unfortunately often the case that he is too eminently practical—that he is, in fact, empirical. He sees nothing useful in attacking a problem except the old and favorite cut-and-try method. He is unaware that a little intelligent thought can save him a great deal of cut-and-try and trouble in his work. He does not realize that the best and most consistent "practice" is that which follows from the combination of the thorough knowledge of fundamental principles of the scientist, with the accurate skill of the artisan. That is the kind of practice of which one might proudly and rightly boast.

What is needed is an institution where the precepts of such rational practice may be taught, and where the electrician may learn to apply them in individual cases. There are schools even now which send out men well versed in the theory of the subject, but these men need the ripening of experience. They are just as much too theoretical as our friends above referred to are too practical. The two are extremes. That is why they never agree. Let us have the two combined in proper proportions, and we may rest assured that the outcome will be an improvement on either. It is the experience of men like Edison that shows us how much this "sweet medium" is really needed. Mr. Edison does not like the "practical" electrician, because he does not know enough about the nature of the case to be intrusted to him, and on the other hand, he does not fancy the theoretical electrician, simply because he is "too helpless." What Mr. Edison needs, and what many others need as well, is a class of electricians who not only understand the fundamental principles of the questions they have to deal with, but who have enough practical experience in manipulation and installation to be able to adapt themselves to the peculiar circumstances of each particular case. These are the kind of men who can take care of their trust in an emergency or under unexpected difficulties. They are self-dependent to a certain extent. They can use their judgment to advantage, and thus become active factors of development, instead of being mere tools of practical application.

We notice that the question of electrical schools is receiving attention in many quarters. The schemes for founding such schools multiply. We feel bound to protest against this condition of affairs. We do not want to see the thing overdone. Let us do one thing at a time, and do it well. One thoroughly good school is worth a dozen indifferent ones. Let us concentrate our efforts on this one until it is a success, and then if it does not fully meet the demand, it will be time enough to found another. When such institutions become so numerous that they must beg for students and enter into competition with each other, the standard of excellence invariably suffers. We would dislike to see "electrical engineers" ground out as incessantly as "M. Ds." are at present from the numerous medical colleges. Let us not by any means permit the electrical school to multiply until it becomes a bane like the "telegraph school," so-called. The telegraph school was, no doubt, a good thing as long as there was but one. But there should not any others have been allowed to come to the surface, as long as one good one was enough. At present it is a nuisance as detestable as it is frequent. The great excellence of the technical institutions of Europe is to be accounted for by the very fact that they are limited in number. It is hard work to gain admission; it is hard work to get through the course, hence the proficiency of their pupils.

Lastly, let us say one word about the faculty of the electrical school. A great deal of the value of such a school depends on the kind of teaching which it gives. Therefore, the most judicious and critical care should be exercised in the selection of these teachers. For our part we would recommend men who are fresh from the field of practical work, rather than men whose notions of practice have been drawn from the laboratory entirely. University men are very good in some departments, but if we want to produce practical men, we should have practical teachers. It strikes us that men like Mr. George A. Hamilton, for instance, are about the right kind, and why would not Mr. Hamilton himself be a most excellent nucleus around whom to organize a faculty? It strikes us that a more balanced, experienced, well-informed electrician, both theoretically and practically, would be hard to find. It is just exactly such men that understand what the electrical engineer *should* know, having learned it by experience, who can impart the right kind of teaching.

It must be borne in mind that the kind of electrical engineer we may expect to get from such schools will depend very much on the quality and the adaptability of the students who shall avail themselves of its facilities. Therefore, here also, some discrimination will be necessary. The profession of electrical engineering is one which requires special faculties of mind and special aptitudes, just as much as the profession of medicine or the profession of mechanical engineering. It is too often the case that men rush into the professions without inquiring whether they possess any talents which fit them for the requirements of professional duties. These are the men who make the professions "overcrowded." If they had only gone into their proper spheres as mechanics, tradesmen or merchants, they would have relieved the profession and the community of a large number of quacks, third-rate lawyers, and so on. It is true that our profession is not overcrowded, as announced by the "agent" of an alleged school of electrical engineering, but that is no reason why we should hasten to pack it full of useless members. It is not so much the lack of more electricians, but the lack of better ones, that demands consideration. We need officers, in a word, and for our part we would be glad to see them drawn "from the ranks," rather than from outside sources. The material in that case would not be so crude, and would require much less handling to give it the right cast. In many cases it is more than half formed already. The men who have been occupying the field should strive to work themselves

up to promotion as electrical engineers, by taking advantage of better educational facilities. Those who have been for several years engaged in telegraphy, telephony or electric lighting, as operators and electricians, who know all about the practical routine of the business, are the very best material from which to make our electrical engineers. They have a familiarity with electrical apparatus, which even the best school cannot hope to inculcate. When they return to the field, after following the curriculum of the schools, they are at once prepared to take charge of their work. They are not "helpless," as Mr. Edison says of the graduate of technical schools, but on the contrary, they feel more "at home" than ever. They do not need to go through a term of probation with their employers. They are recognized as competent from the start.

We have been among the first to urge the importance of self-improvement in the ranks of the profession, and we commend this additional suggestion to its members as one of much importance.

A Suggestion about Working Induction Coils.

The induction coil is a wonderful apparatus, judged by its effects. The variety of uses to which it has been put have made it an interesting object. Between the small "shocking" coil of the medical apparatus and the large Ruhmkorff coil of the physical laboratory there are a thousand and one types and forms of induction coils in use. It is familiar to the electrician, who meets it constantly in one form or another. Indeed, many electricians owe their interest in the science to the attractiveness of induction coil experiments. Even the well-known medical coil has a kind of "witch-craft" about it which is all-sufficient to fasten the interest of an observing mind and stimulate an appetite for a better knowledge of it.

All those who have had occasion to work the induction coil know that it is apt to be remiss just when least expected. We refer, of course, to induction coils where the primary circuit is broken regularly by an automatic vibrator. The trouble always arises from the vibrator. It is often difficult to make the vibrator work properly, and, in fact, sometimes it proves no easy task to make it work at all. The vibrator, as is well known, carries a small armature, which is attracted by the iron core of the induction coil, or else by a small special magnet in the primary circuit. The effects of the induction coil depend on the rapidity of the breaks or interruptions caused in the current by the vibration of the armature. The more rapid the breaks in the primary circuit, the more intense and powerful the induced currents are. If the spring happens to be rather tight, or the current too weak, then the armature is not attracted with sufficient force to pull it away and separate the contact points, and the vibrator will only move very slowly, if at all. The resistance of the point of contact may be so great as to reduce the current, and thus help to produce the same result.

M. de Tromelin, in a recent number of *L'Electricité*, proposes a simple expedient for such cases. It consists in artificially polarizing both the armature and the core of the coil itself, or of the special magnet attracting it, by means of a permanent magnet. He takes a magnet and places it in front of the coil so that the armature will be between one of its poles and the attracting core. In this condition it will be seen that both the attracting core and the armature are magnetized by induction and tend to attract each other with a force depending upon the power of the permanent magnet and the distance at which it is held from them. On passing the weak current, less magnetic effort is required of it to force the armature to move, provided, of course, that the polarity induced by the permanent magnet is in the same direction as that produced in the attracting core by the current. If the polarities are in reversed directions, then they simply neutralize each other. If the armature fails to move, then the magnet should be reversed, so as to present its other pole. If the armature fails to move even then, the current must be insufficient, and the trouble lies in the battery.

This expedient is certainly very simple, and M. de Tromelin states that it enables the induction coil to produce much larger sparks with a weak current. In using Ruhmkorff coils the suggestions will prove especially useful. Oftentimes the current available is not very strong, and it may be even insufficient to work the coil at all. M. de Tromelin states that even when the permanent magnet is made to act on the remote end of the core, the results are still better than without the use of the magnet. This must be evident, for although the inducing magnet is further removed, yet the action must be felt throughout the whole length of the core. If there are two small induction coils, then they may be placed side by side and a horse shoe magnet can be used so as to strengthen both, one pole being placed near each core. The only thing to be done is to connect the coils so that the polarities will "mate" in each case with the pole presented.

M. de Tromelin states that the two induction coils, if of equal size, may be made to work in series or multiple circuit; though in working them in series it is necessary that the vibrator of only one should be allowed to operate.

An interesting experiment is described by M. de Tromelin, which illustrates the same principle. He finds that when a Bell receiver is connected with the secondary circuit of an induction coil near which a permanent magnet is held, the sounds vary according to the distance between the magnet and the telephone. It is claimed that the tones vary through all the shades in pitch of the chromatic scale, just as when the vibrator is made to change in speed by adjusting it differently. It is evident that each impulse of current in the induction coil must be reproduced at the telephone, and their rapidity of succession determines the pitch of the tone. With a permanent magnet held near, we suppose that retardation takes place in the vibration of the diaphragm of the receiver, and consequently it follows that as the magnet is moved away the pitch of the tone must rise. The experiment is said to succeed better with the Gower variety of telephone.

We might add, *en passant*, that a modification of the Bell receiver, contemporaneous with the Gower receiver, contains the suggestion of the idea advanced by M. de Tromelin. We remember that in the Gowen telephone the two poles of the magnet are brought closely together near the diaphragm, which is of iron, as usual. M. Ader conceived the happy idea of strengthening the magnetic field acting upon the diaphragm by placing a soft iron ring in the mouth-piece around its opening. This "armature" being thus placed outside the diaphragm, and having more mass, concentrated the lines of magnetic force of the magnet more effectually, and the thin diaphragm is therefore placed in a more intense magnetic field than would otherwise be the case. In other words, the iron ring becomes a magnet by induction and reacts on the diaphragm to help the action of the magnet. The receiver is said to be remarkably sensitive and efficient, and certainly it seems as if this application of the principle of magnetic reaction known long ago were a rational and a scientific one. The reader will see that the principle is essentially the same as in M. de Tromelin's application.

It may be proper to speak of a method of applying the idea of M. de Tromelin, which occurs to us at this moment and might be useful. Instead of making the core of induction coils entirely of soft iron, a small central steel wire may be used which can answer the purpose of a permanent magnet. By pushing this steel rod in or pulling it out, the magnetic moment exerted on the armature of the vibrator could easily be regulated to a considerable extent. Those who experiment with small coils and small batteries and have not the facilities of a large laboratory for keeping their induction coils and batteries always in good order will find the idea worth trying.

Death of an American Electrician.

Mr. William E. Sawyer, a well known electrician and electric light engineer, died at his residence in this city, on the 15th inst. Mr. Sawyer will be remembered as one of the pioneers in the field of electric lighting in America. His career as an electrician was begun under very favorable auspices, and it is a pity that it should have proven but a record of neglected opportunities. Unfortunately for Mr. Sawyer, his nature combined discordant elements of character; his disposition was governed by traits at once uncongenial and incompatible with each other. He was not lacking in the essential qualities of ability and genius. On the contrary, he possessed undoubted talent as an electrician. But his character was not possessed of that fixedness and stability which command success. His erratic and careless habits were perpetually at war with his talents, and led him continually into difficulty.

He achieved fame and fortune at an early date. It is said that his inventions formed the basis of the first electric light company in America—the United States Electric Light Company—who retained his services on a contract of several years, at a munificent salary. Mr. Sawyer only remained a few weeks, however, and then threw up his contract. It is said also that the $50,000 which he received for his inventions soon disappeared. He then gave his attention anew to electric lighting, and a new company, the Sawyer-Mann Electric Light Company, was formed to operate his incandescent system. It appears that he was at work on an incandescent system much sooner than Edison or Maxim, and that he was successful in contests with them for priority in the Patent Office.

A difficulty arose between Mr. Sawyer and a Dr. Steele, who boarded at the same place where he lived, which culminated, on the 5th of May, 1880, in an altercation, in which Mr. Sawyer shot Dr. Steele. Mr. Sawyer was arrested, and when the trial took place in March, 1881, he was convicted and sentenced to four years' imprisonment at hard labor. An appeal was made, and as his health was poor, he was permitted to remain at his home pending the appeal. The Court of Appeals affirmed the decision of the Court of General Sessions, and Mr. Sawyer then sought pardon from the governor. As his health was such that his removal was considered dangerous, he was permitted to remain at his house. The District Attorney consented to delay in moving for sentence for one month, which expired May 16, but before the time had expired he received official notice of the death of Mr. Sawyer.

In the beginning of 1831 Mr. Sawyer published a book on "Electric Lighting by Incandescence," which, for a time, was the best work on the subject. The Sawyer-Mann Company did not live long, and Mr. Sawyer started one or two other companies, which shared the same fate. He then turned his attention to the electric railroad, and managed to produce a sensation once more. He had lately given considerable attention to perfecting his electric railroad. At the time of his death it is said that he had several applications for patents in course of preparation, to cover the distinctive features of his inventions.

As an electrician, Mr. Sawyer belonged to the practical school rather than to the scientific. His inventions are not so remarkable for originality of conception as for ingenuity of application. In a word, his genius was constructive rather than creative, His inventions were bright innovations of old ideas, rather than departures toward new principles.

Electric Storms.

Foreign meteorologists have recently been investigating the phenomena of electric storms. Professor Möhn classifies them as heat and cyclonic thunder storms. In the lower latitudes and in summer the heat storms prevail, while on the Northern Atlantic and generally in the higher latitudes, as Iceland and Norway, the electrical storms are cyclonic. They have their maximum in winter, and though they may occur at any hour of the day, are most frequent at night.

Nature says: "Of the twenty-three cyclonic thunder storms which occurred in Iceland in fourteen years, only three took place at an hour of the day when the sun was above the horizon." Statistics of the weather bureau show that the heat thunder storms in our latitudes are most frequent between two and six o'clock p. m. Commenting on the recent thunder storms in the South, an exchange says:

"The electric storm is no doubt always the result of a sudden and considerable condensation of water vapor consequent on the commixture of cold and warm moist currents, and may therefore be anticipated in districts over which the weather reports indicate that the southerly winds will be replaced by fresh to strong northerly winds. This simple rule for the prevision of thunder storms might often be the means, if systematically applied, of saving life at this season."

Mr. Symons, an English meteorologist, has been investigating the nature of "heat lightning," generally supposed to be harmless, and declares that this is by no means invariably the case. He shows that its beautiful flashes are often due to disastrous thunder storms at no great distance.

The Electrical Voting Apparatus.

It will be gratifying to tax-payers to know that an invention for economizing time in Congress is in preparation. It is an electrical voting apparatus for the House of Representatives, by means of which the vote of each member will be instantaneously recorded and announced. The idea, although brilliant, is not new. A similar machine has been in use in Europe for some time, and Mr. Edison and Congressman Springer have twice urged Congress to adopt it. That such a machine would facilitate business and be an advantage in many respects, no one who knows anything of the workings of that arbitrary legislative engine called congress, no one doubts. The House of Representatives sits but a few hours every week, and now that the number of its members has been increased to 325, a single roll-call consumes half an hour or more. Time is money everywhere, and in Congress it is a considerable amount of money. Any device which will save time and compel close attention on the part of members is in the nature of a boon to their constituency. If a vote could be taken in a minute or two, and the record was automatic and inexorable, each member would be obliged to give his undivided attention, and "jobs" would languish while the country thrived.

Lightning in Telephone Exchanges.

Lightning makes sad havoc in a telephone exchange when it has an opportunity. It is but a few weeks since we recorded almost the complete destruction by lightning of the Indianapolis exchange, and now we have a report of a similar occurrence in the Omaha exchange, where, about three o'clock on the morning of the 8th inst., some 400 connections were burned out, and the building was set on fire, but was saved by the exertions of the operator and the firemen. In both cases the service is reported to have been suspended for several days. These events show that the forms of "lightning-arresters" hitherto used, and which have been found sufficient for the protection of our telegraph offices against atmospheric electricity, do not adequately guard the complex network of wires and the delicate mechanism of the telephone exchange, and that there is excellent opportunity for some of our electrical inventors to exercise their ingenuity in the production of a more satisfactory device. Let us have a lightning-arrester that will arrest.

Microphonic Contacts.

The following interesting paper, by Mr. Shelford Bidwell, read before the English Society of Telegraph Engineers and Electricians on April 12, we find in the London *Electrical Review:*

Loose contacts are proverbial for the uncertainty of their action, and it was to be expected that an investigation into their action would prove troublesome, and the results obtained by no means uniform. But by multiplying experiments, the element of uncertainity has been to a great extent removed, and several interesting facts seem to be clearly established. The arrangement adopted for nearly all the experiments consisted of a little balance, formed of a light steel rod balanced on a knife-edge fixed at right-angles to it. To one end of the rod was attached a split tube of thin copper, for holding short rods of the different substances to be tested, which were held so as so press at right-angles upon another rod held in a spring clamp. A scale-pan and a sliding counterpoise enabled different pressures to be exerted between the two microphonic surfaces. The object of the first experiments was to ascertain the effects of various pressures upon the resistance of two carbon rods, the measurements being made with a Wheatstone's bridge in the ordinary manner. The rods selected were electric-light pencils of gas carbon, 6 mm. in diameter. In all, seventeen series of observations were thus made, the weights in the scale-pan varying from 5 grammes to 100 grammes. The mean of three of these, the weights and corresponding resistances, plotted out so as to form a curve, showed clearly that the greatest variations occur when the pressure is small and the resistances comparatively high. Thus, between 0.25 grammes and 5 grammes the resistance falls 5.1 ohms, while between 25 and 50 it only falls 0.3 ohms. It soon became evident that the resistance of the carbon contact was largely dependent upon the electromotive force or the strength of the current used, the resistance falling with increase in the current. Thus, when the pressure was 0.25 grammes the resistance with 1, 2, 3 or 4 cells was 11.10, 7.20, 4.70 and 3.55 ohms, respectively.

The resistance of the carbon contacts varied greatly with the strength of the current when the pressure was small, and but very slightly when the pressure was great. It is clear, therefore, that the diminution of resistance which occurs when the pressure between the carbon contacts is increased, is not under ordinary circumstances due solely to the increase of pressure; for the diminished resistance which results from the increased pressure causes an increase in the strength of the current, the effect of which is a still further fall in the resistance. Thus the total diminution of resistance is due only partly to increase of pressure, and partly also to increased strength of current. With small pressures the resistance is largely dependent on the strength of the current, but when the pressure is considerable the resistance with weak and strong currents is nearly the same.

A few experiments were made in order to ascertain whether the diminution of resistance under pressure was entirely of a temporary nature, or whether it continued in any degree after the pressure had been removed. A weight of 1 gramme being in the scale-pan, the resistance of the contact was measured with the Wheatstone's bridge and one Leclanché cell; the 5-gramme weight was then lowered into the pan, and a measurement made of the diminished resistance. The 5-gramme weight was again gently raised, and the resistance with a single gramme once more measured. In every case it was found to have returned almost exactly to its original value. The experiment was repeated with a resistance of 300 ohms between the battery and the bridge, that the current might be smaller. The results were substantially the same as before. It was noticed, however, that the final resistance was almost invariably slightly higher than the original resistance, but this increased resistance gradually diminished, and perhaps, if time were given, it would return to its original value. There is little doubt that this is a thermo-electric effect. Since, as is well known, the resistance of a continuous conductor of carbon is diminished by heat, it might perhaps be supposed that the diminution which the resistance of carbon contacts exhibits under the influence of increased currents is due simply to the heating effect of the current. Experiments made with the view of testing this hypothesis failed, however, to support it. The carbon balance, with a weight of 2 grammes in the scale-pan, was placed in an air-bath, the bulb of a thermometer being very near the points of contact; the temperature was slowly raised, and the resistance was from time to time measured in the ordinary way. At 16° (the temperature of the room) the resistance was 9 ohms. As the temperature rose the resistance varied irregularly, increasing, however, on the whole, and never becoming less than it was at first, until at 50° it had become 10.7 ohms. The experiment was repeated with a weight of 10 grammes in the scale-pan. The resistance at 17° was 4.7 ohms. As in the former case, the resistance rose and fell irregularly as the temperature increased until 31°, when it was 4.7 ohms—exactly the same as at first. From this point it increased with great steadiness and regularity to 5.7 ohms at a temperature of 50°.

Under certain circumstances the current appears to produce a permanent and not merely temporary effect upon the resistance; that is to say, the resistance of the contacts is found to be lower (or higher) after the current has ceased than it was at first. When the proportion of the current strength to the pressure at the points of contact exceeds a certain limit, the effect of the current is apparently to produce a permanent *increase* in the resistance, and this increase is sometimes very considerable. The resistance does not rise gradually, but suddenly, generally after the circuit has been closed from two to ten seconds, and at the moment of the rise a minute flash of light appears at the points of contact. The galvanometer needle suddenly goes to zero, and when this has occurred no deflection whatever is produced on opening and closing the circuit with a key. A slight vibration, however, partly or wholly restores the conductivity of the carbon, and, curiously enough, the same effect is often produced by the feeble current used to measure the resistance. Thus it may happen that, while the moment before measurement the resistance may be infinite, the very act of measurement reduces it to a few hundred ohms.

The experiments made with metals were less numerous than those with carbon. Metallic loose contacts were found to be even more uncertain in their action than those of carbon, and to obtain a really fair average of results a very great number of measurements would be required. Under precisely the same conditions, as nearly as they could be reproduced, the results obtained were frequently very different. Nevertheless, it has been possible to bring out with sufficient distinctness some remarkable peculiarities in the behavior of metallic contacts. The metal principally used was bismuth, which was selected on account of its high specific resistance, but a few experiments were also made with copper and platinum. The cylinders of bismuth and copper were of nearly the same diameter as those of the carbon previously used—6 mm. The platinum was prepared by soldering wires of that metal upon cylinders of brass. The first unexpected phenomenon which attracted notice in working with bismuth was the very great permanent fall in the resistance which was produced by an ordinary current with light pressures. Using a single Leclanché cell, the lightest contact—the pressure being certainly less than .01 gramme—failed to give a higher resistance than 9 ohms; but with 400 ohms inserted between the battery and the Wheatstone bridge, a pressure of .35 grammes gave a resistance which on different occasions varied between 73 and 110 ohms. When once, however, the resistance has been reduced by a strong current, the changes which occur when feebler currents are used are comparatively small, unless, of course, the points of contact are first separated A *small* weight being in the scale-pan, if a weak current were caused to pass through the points of contact, the resistance was found to be high. When a strong current was passed, the resistance was greatly diminished. And when the current was reduced to its original strength, the resistance did not rise to its original value; in fact, it did not rise at all—it was still further diminished.

Repeating with bismuth the experiments made in the case of carbon, it was clear that the diminution of resistance effected by pressure was generally of a permanent nature, continuing to a great extent after the pressure has been removed (so long as the points of contact remain undisturbed), and thus reversing the case of carbon. With strong currents the variations of resistance were so uncertain and irregular that accurate measurements were impossible; but with a resistance of 300 ohms between the battery and the bridge the effect was very clearly marked.

When a tangent galvanometer was inserted in the circuit it at once became evident that when the condition of the microphone was at its best the current was strongest. It appeared probable, therefore, that the magnitude of the apparent repulsive effect produced between two contacts, as discovered by Mr. Stroh, depended merely upon the strength of the current which was passing at the moment, and that the excellence of the microphonic effect had really nothing to do with the matter. The upper carbon was therefore pressed down with a weight too heavy to admit of the ticking of the watch being heard, and a steady current was thus secured without any difficulty. It was now found that the repulsive effect was almost, if not quite, as great as it was when the carbons were in loose contact, and little doubt was left that the phenomenon was merely a case of expansion due to the heating effect of the current. Cylinders of bismuth were then substituted for the carbon rods, and a similar effect was produced, the movement of the spot of light being somewhat greater than it was with carbon. With copper the apparent repulsion was rather less than with carbon, but perfectly well marked. Lead was then tried, being chosen on account of its high coefficient of expansion and its inferior conductivity for heat and electricity, and, as was expected, the deflection of the spot of light was very considerable, being about six times as great as in the case of carbon.

The results of the experiments may perhaps throw some light on a matter which has never hitherto been fully explained. Why does carbon give better results than any metal when used in the microphone? It seems that this question may be very easily answered. The mere fact that a current causes delicately-adjusted metal contacts to adhere to each other is sufficient to account for the superior efficiency of carbon. It is possible, indeed, to transmit articulate sounds by means of a metal microphone, as is proved by some of Professor Hughes' earliest experiments, but the action of such an instrument, as compared with one of carbon, is extremely uncertain and imperfect. This is, no doubt, due to the fact that, although vibrations corresponding to the fundamental tone are easily produced, the minute super-imposed vibrations due to the upper partials, upon which depends the distinctive character of a particular sound, are, owing to the adhesion, very imperfectly represented, if not entirely lost.

The question as to whether it is preferable to arrange the elements in series or in multiple arc is very easily answered. If the elements are in series the whole of the current used will pass through each of them; while if they are in multiple arc the current will be subdivided and each element will be traversed by a current the strength of which (supposing them all to be equal) will be inversely proportional to the number of elements. Now, the sensitiveness of the contacts to changes of pressure has been shown to increase greatly with small currents, and hence it follows that the multiple arc is to be preferred to the series system. The same reasoning, in a modified form, will condemn a system in which series and multiple arrangements are combined; for the greatest perfection, therefore, the multiple arc system pure and simple should be adopted.

Since the efficiency of a microphone depends principally upon its power of varying the strength of the current in a circuit comprising the microphone, a battery and the primary wire of an induction coil, it is clear that the electromotive force of the battery should be as high as is consistent with other conditions, and the resistance of the battery coil and microphone should be low, for the proportional change of resistance caused by sonorous vibrations remaining the same, the stronger the maximum and minimum currents the greater will be the actual difference between them. But for securing sensitiveness it is very important that the current passing through the microphone should not exceed a certain strength, and, indeed, if the pressure is light (as it should be) a strong current will enormously increase the resistance of the contacts or some of them, thus impairing or utterly destroying the efficiency of the instrument. The general conclusions that may be derived from the investigations are that (1) the constituent elements of a microphone should be numerous. (2) They should be arranged in multiple arc. (3) They should be heavy. (4) The pressure at the points of contact should be light. (5) The resistance of the microphonic system should depend upon the resistance of the rest of the circuit (which should be small) and upon its sensitiveness to changes of pressure. In general it should be small. (6) Up to a certain limit, depending upon the number of contacts and their pressures, the current used should be strong.

During the discussion which followed the reading of this paper, Mr. Stroh gave an account of the following experiments:

The microphone used was again of the hammer-and-anvil pattern (same as described and illustrated in THE ELECTRICAL WORLD of March 31, 1883, page 199) this form being most suitable for experiment.

On a little board *A*, Fig. 1, was fixed by means of a brass holder *a* a thin carbon rod *b*. Against the end of the lat-

FIG.1.

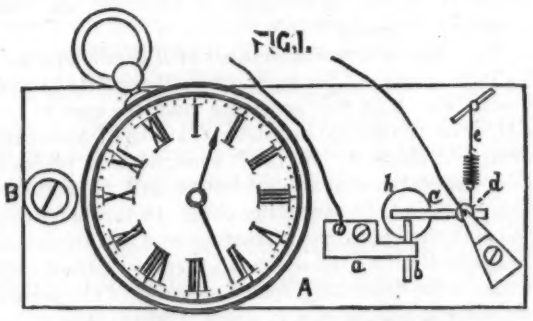
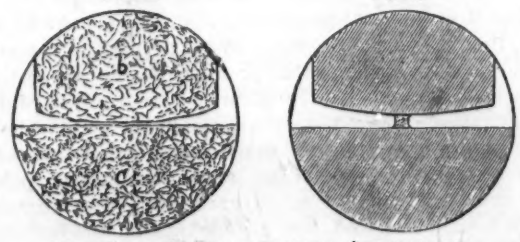


FIG.2 FIG.3



MR. STROH'S MICROPHONIC APPARATUS.

ter rested loosely another carbon rod *c*, which was mounted on a little spindle *d*, and a small spiral spring *e* served to vary the pressure at the contact between the two carbons *b* and *c*.

The object of this arrangement was that the points of contact might be brought under a microscope, and for that reason the carbons, where they came into contact with each other, were made as flat as possible and also thin at the edges, so that they might be fairly brought into the focus of the microscope.

The little board *A* on which was placed a loud ticking watch as a source of sound, was fixed at *B* on a stand apart from that of the microscope, so that touching and adjusting the latter might not interfere with the microphone. A hole in the board at *h*, under the contact, is necessary to admit light from below.

In the circuit with the microphone were a telephone, a make-and-break key and a small battery of 1 to 3 cells.

The two edges of the carbon contact, although they were made with care, appeared rough and jagged through the microscope, as represented in Fig. 2, and before the current passed only one or two of the projecting points were seen in contact.

The tension of the spring for the first observation was such as was known by experience to be necessary to insure microphonic contact. By depressing the key a current from two cells was now sent through the circuit, and the effect was closely observed by means of the microscope. What was noticed was a light, or in fact a burning away of the carbon; the two carbons came closer together during that burning, and presently another contact was made and another light became visible. The carbons still approached until three or four points were in contact, each of which was illuminated, and at last, as it appeared, when there were a sufficient number of points of contact for the greater portion of the current to pass, then the burning ceased and the ticking of the watch could be heard in the telephone.

All this took place in the course of a few seconds, and while the microphonic condition remained no light could be seen at the point of contact. But as soon as the battery power was increased the burning commenced again, and continued until the area of contact was sufficiently enlarged, and consequently the resistance so far reduced that the degree of heat which was still produced was below that which causes the combustion of the carbon.

This agrees with Mr. Bidwell's observation, viz.: That the resistance of the contact falls with an increase of current.

The pressure at the contact was now reduced to a minimum by letting down the tension-spring so that the two carbons were only just in contact and no more, and when a current from the two cells was allowed to pass, a momentary burning at the contact, accompanied by a click in the telephone, was observed; then followed an interruption and the current would pass no more.

By making contact with the key many times no trace of current could be detected with the telephone, showing that after the first passage of the current great resistance was established. This is also an effect observed and investigated by Mr. Bidwell.

The tension-spring was now slightly tightened; this evidently caused the insulating film or substance which prevented the current from passing to be forced aside or broken through, for another current passed on making contact, but only for a moment, and then again an interruption occurred. This could be repeated several times, until the spring was wound so tight that the insulating substance was broken through as soon as it was formed, and then the well-known boiling or hissing noise, which we hear when the microphone is out of adjustment, could be heard in the telephone. Sometimes the noise was a perfectly clear musical note, and by adjustment of the spring it occasionally became as shrill as a whistle.

It was found possible to adjust the microphone, so that while still listening to the noise the watch could be heard as well, and whenever this was successfully accomplished the tick of the watch was heard louder than under any other circumstance.

That experiment was made with a telephone of considerable resistance, which was now replaced by one of a very small resistance, only a few ohms, and an entirely different effect was obtained.

The spring was again let down so that the carbons were only just in contact. A momentary burning was seen as before on passing the current, but the movable carbon was also driven away from the fixed carbon and apparently remained repelled at some distance. Each time the circuit was completed by the key the movable carbon was driven away, and a continuous stream of sparks could be seen flying across the space.

The sound produced in the telephone by this effect resembled the crackling of burning wood. By tightening the spring the noise was frequently changed into a musical note, the pitch of which rose with the pressure.

By closer observation exceedingly fine dark lines could be seen, which reached from every projection of the jagged edge of the loose carbon right across the space to the fixed carbon. This showed that the movable or loose carbon was in a state of vibration, the amplitude of which was equal to the distance of the apparent separation of the two carbons.

This distance, which was considerable when the rate of vibration was low, became rapidly less as the rate was increased by tightening the tension-spring, and a point was soon reached when the separation could no longer be seen, but was likely still to exist during the production of the higher sounds.

Another effect which was occasionally observed with the microscope during the production of the various noises above mentioned was that little fragments of carbon, which probably became detached by their expansion by heat but still remained between the electrodes, were in a state of agitation.

There can be no doubt that during the production of these singing, hissing or boiling noises the current cannot be a constant one, but that in the case of the former it must be intermitted and of equal periods, while in the case of the latter it is probably undulatory and of unequal or irregular periods.

It also appears evident that a current crossing a microphonic contact has a strong tendency to cause vibratory disturbances, and it seems, therefore, reasonable to suppose that during microphonic action, even when all is in good adjustment, the sound waves which are transmitted are accompanied by other vibrations, which are due to the passage of the current itself.

The following reasoning has led to this supposition. Whenever it was possible to adjust the microphone so that the ticking of the watch could be heard during the production of singing or hissing noises, the timbre or quality of the sound of the ticking was exactly that of the hissing noise, and any change in the character of the latter was always accompanied by a corresponding change of the former.

It being a fact that sudden slight changes in the quality of sound are sometimes observed, even when the adjustment of the microphone is perfect, that is to say, when no singing or hissing noises are heard, it must be that whenever sound-waves are transmitted these have super-imposed upon them other vibrations, possibly of a very high rate or pitch, which vary and so produce change of timbre or quality. The latter would be the vibrations or disturbances produced by the passage of the current across the contact.

In the next experiment metallic contacts were substituted for the carbon ones. With platinum very good microphonic effects have been obtained whenever sticking could be avoided.

With a view to prevent sticking, a little oil was placed on the platinum contacts, but quite a different and unexpected phenomenon was observed. The oil by its capillary attraction remains surrounding the contact, and when the adjustment was so that the ticking of the watch could be heard, little particles of dust or carbon which happened to be in the oil were seen in violent agitation, spinning round with great rapidity.

It was puzzling for a time as to what caused these particles to be agitated in so violent a manner, but it appeared afterward that it was probably the effect of heat. The oil seemed to be boiling at the point of contact, even with a single cell, and when an exceedingly fine thread of smoke was observed arising from the contact it was concluded that such must be the case.

A number of carbon partiles were then placed upon the oil, and when the current was again sent through and allowed to continue for a minute or so, the whole of the carbon dust, which was at first violently rotated and started in all directions, accumulated by degrees round the point of contact, and at last built up a pillar, which forced the electrodes wide apart and took the shape shown in Fig. 3.

Steel contacts were now substituted for platinum, and with them the same experiments turned out equally successful; but another curious phenomenon was observed: The black particles in the oil continued their movements for a considerable time after the current had been interrupted by the key. In some cases it took quite two minutes before they came entirely to rest.

Having also ascertained that a pillar could be formed with and without the carbon dust in the oil, the latter was now taken away altogether, and it was found that by a a little humoring a pillar could be caused to grow even when the contacts were perfectly dry and clean.

This pillar, while in course of formation, had the appearance of being in a state of low incandescence, but it was concluded afterward that it was only surrounded by a dull red glow, which appeared to be really a succession of sparks running along the surface of the pillar.

In concluding his remarks, Mr. Stroh said that he did not think at present that the formation of the pillar was directly connected with microphonic action, but he regarded more it as a secondary effect. He deemed it advisable, however, that all observed effects should be recorded, and that by collecting and compiling them we may help in time to unravel the mystery which stills clings to microphonic contacts.

Electric Lighting.—XXVI.

VON HEFNER ALTENECK.

The Alteneck differential lamp is better known as the Siemens lamp, because it is made by Messrs. Siemens, by whom M. Alteneck is employed in the capacity of electrical engineer. No efforts appear to have been made by Messrs. Siemens to publish the fact that this lamp embodied the differential principle. Consequently while many of the lamps soon passed into use in Europe its peculiarity of construction remained for a time unknown to electricians. It was not until the Lontin-Serrin lamp had been spoken of in scientific journals that the Alteneck lamp was described and illustrated. However, it is placed on record by patents obtained upon it in various European countries; and it appears from these that it was brought out before Lontin conceived the differential principle, thought it did not precede the Tchikoleff lamp. This lamp is interesting as a type whose excellence has made it successful. It contains nearly all the elements of a perfect arc regulator, and I believe it is a good combination. Others share this opinion, for it enjoys the distinction of having been copied and imitated to a large extent, even in this country.

The lamp possesses two features of resemblance to the Lacassagne and Thiers lamp: The approach of the carbons is caused by gravity, and the regulation of the feed is controlled by an armature acted upon at one end by the magnetic power obtained from the main circuit, while its motion is counteracted at the other end by the magnetic power of a derived circuit. In details the lamps differ entirely. Instead of electro-magnets, the Alteneck lamp employs solenoids, and the approach of the carbons is

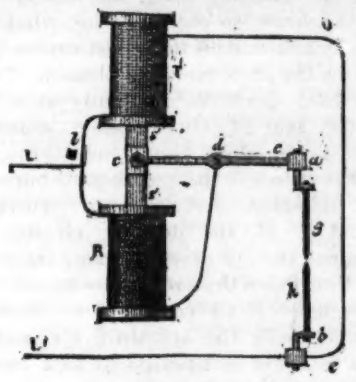


FIG. 82.

brought about by the gravity of the upper carbon holder, the motion being retarded by a system of clock-work, with an escapement-wheel and pendulum, on the principle of the Serrin and other similar lamps. In essence it is a clock-work lamp. In order to explain the differential principle of its action, we will reduce the lamp to its simplest conception, as shown in the diagram—Fig. 82. There are two solenoids *T R* one above the other. An iron rod *s s'* which moves up and down inside the solenoids answers the purpose of armature for these solenoids, and by its motion causes a lever pivoted at *d* to oscillate. To this lever is attached the clockwork into which the rack carrying the upper carbon holder gears. For simplicity the carbon is shown attached directly to the lever at *c* by a clamp *a*. One of the solenoids *R* is of large wire and is in the main circuit, while the other solenoid *T* is in the derived circuit. This may be understood by following the connections in the diagram. The current from the positive pole of the dynamo-electric machine enters at *L* and divides into two courses. The main circuit is through *R* to the framework of the lamp *d*, to the upper carbon *g*, to the

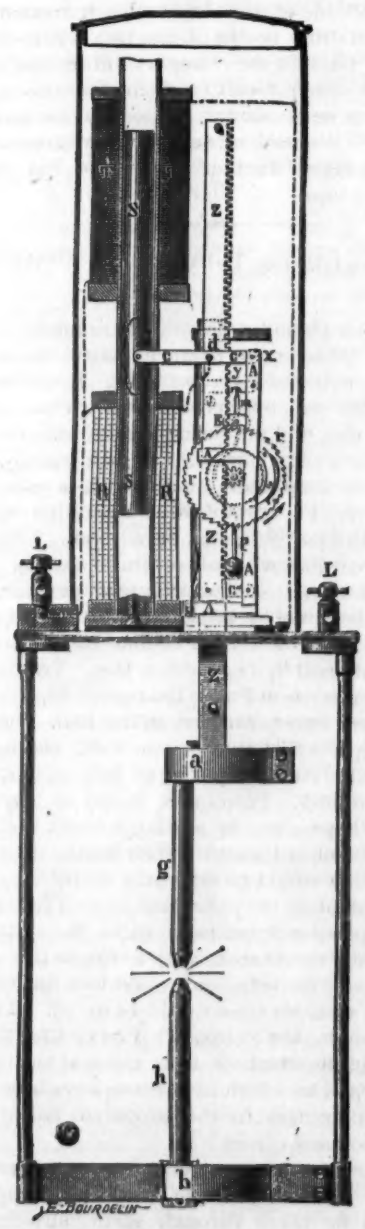


FIG. 83.

lower carbon *h* and out by the conductor *L'*. The derived circuit is through the solenoid *T* and around the arc to the lower carbonholder, or more properly to the negative conductor *L'*. On passing the current the iron rod *c* which slides into both solenoids is sucked or pulled into the lower solenoid *R*, and causes the arm *d* which is pivoted to it to tilt on the suspension point *d*. This raises

the upper carbon and establishes the arc. A small portion of current passes around by the derived current and tends to check the iron rod *c* and prevent its lowering too far. As the arc increases in length the proportion of current diverted through the solenoid *T* increases also, until its power is enough to pull the iron rod *s s'* upward. This has the effect of making the carbons come nearer to each other. In the lamp itself, the moment the magnet *R* causes the lever to oscillate the whole clock-work mechanism is raised with the upper carbon rack, and at the same time the escapement is released. The upper carbon therefore, descends gradually at a rate nearly equal to the rate of consumption, consequently, the oscillating lever does not need to move; and it is only when the carbons burn too fast that the increased diversion of current through the solenoid *T* of the derived circuit comes into play to move the clock-work mechanism downward bodily and thus move the carbon downward more rapidly. On the other hand, if the carbon moves down too fast the lower solenoid pulls the armature *s s'*, and causes the mechanism to lower sufficiently to lock the escapement and stop the descent of the carbon.

Fig. 83 represents the general construction of the lamps. But little description will be needed to give an idea of its peculiarities. The letters correspond in both figures. It will be seen that instead of attaching the carbon rod to the oscillating lever *G G'*, a vertical arm *A A* is pivoted to it. This arm is similarly pivoted below at *C'*, and can move up and down. The rack *Z*, carrying the upper carbon holder gears into a small pinion of the clock-work mechanism. This clock-work mechanism is lifted up every time the iron amature *S S* is drawn down, consequently it lifts up the rack *Z*. At the same time the pendulum is released, because its upper extension, which was held in a notch *m* in a small horizontal lever, becomes released by the upward motion of this lever. The action of the regulator will now be plainly understood without further details.

The use of solenoids instead of magnets is a very good idea. When the helix contains an iron core the attraction varies as the square of the distance, consequently the action on the armature is not equal for all points of its motion. When there is no core, as in solenoids, the attraction is more gradual, and for small ranges of motion it remains equal. The armature may be allowed more amplitude of motion, and yet remain as sensible to the controlling power of the magnetism developed by the coils. Besides, the changes of magnetic attraction of the helices which result from fluctuations of the current do not cause such abrupt motions of the parts. The attraction of a solenoid is exerted more gradually, and for this reason many fluctuations do not last sufficiently to cause a reaction.

C. O. M.

Registering Policemen by Electricity.

The higher planes of invention are surely being reached. The latest achievement in the electrical line is a device for registering policemen by electricity. Inventive genius had an eye to the street-car conductor's overpowering temptations long ago, and provided the bell-punch as a safeguard. Other public functionaries have had equally brilliant implements to keep them in the narrow path of duty, but the policeman has heretofore had it all his own way. His day of unfettered action is now over. Electricity is the sleepless guardian who takes him in charge. The electric patrol indicator, an invention to register policemen at their posts, is about to be brought into use in this city. The apparatus, which is similar to that in a district telegraph box, is contained in a round iron box. Two have for some weeks been in use at Police Headquarters, on either side of the Mulberry street entrance, in the hall. Superintendent Crowley reports that they work well, and has decided to ask the Police Board to put up an indicator on every patrol post in the city. Patrolmen would be required to announce their presence by pulling a crank in the box every time they reached the end of their beats. It is argued that the apparatus would be especially useful in case of accidents by enabling the policeman to send for an ambulance from his post, without running to the station. People, learning this, would soon cease to run to the often distant police stations for help, and would look for the patrolman. Thus most valuable time would be saved. Boxes are now being put up in the Thirteenth Precinct for the approaching exhibition which is to be given at the Central Office this week and to which invitations have been issued from police headquarters to the Brooklyn police authorities, Mayor Edson and others.

The *Star* of this city, referring to this subject, says: Electricity is the master of all the elements, shooting straight to its mark through earth, air, fire or water. Half its potentialities have not yet been discovered. The latest utilization of it is designed to give it a silver shield and appoint it a general roundsman, to watch and supervise the whole police force of the city. With its attribute of omnipresence it will stand at the end of every beat and mercilessly report every patrolman who fails to register at the proper time. This is clearly a step in the right direction, and its value will be enhanced when to each indicator will be attached a pair of electrical handcuffs to hold one prisoner while the officer chases his pal. Then, if Edison, or some other wizard of that ilk, will invent an electric club guaranteed to subjugate an unruly offender by merely touching him, instead of banging him, the advent of the millennium will be very much hastened.

Pittsburg Telephone Notes.

About a year ago, the Central District and Printing Telegraph Company, of Pittsburgh (the telephone company), put down several underground cables in the business centre of the city. The cables are of the Patterson type, made by the Western Electric Company, in Chicago. There are three of them, each containing fifty conductors, incased in lead pipes. The conductors are of ordinary cotton-covered wire, and a high insulation is obtained by forcing paraffine into the pipes by hydraulic pressure. The cables were laid for a length of about one thousand feet in wooden boxes filled with asphalt. Although the experiment through so limited a distance can have but little value as regard the vexed questions of induction and retardiation, yet it has been found so satisfactory that the company is about to largly extend the system by laying fifteen more cables, of fifty wires each, and from 3,000 to 3,500 feet long. When this is done the company will have nearly five hundred wires underground, or an aggregate length of 120 miles. This is considered the beginning of the system which will eventually place all the telephone wires in the city under ground.

The report that the American Bell Telephone Company had relinquished its controlling interest in the Pittsburgh company has been affirmed and denied, and officers of the latter company are disposed to be reticent on the subject. It is known that upon the return of the Pittsburgh committee from Boston, a few days ago, the purchase of the Union Electric Conduit Company of Pittsburgh was consummated by the C. D. & P. T. Co., which has thereby doubled its capital, but just how this affects the parent company's interest has not been made public.

Superintendent Merrihew, of the Western Union Company, in New York, was in Pittsburgh last week, negotiating with the telephone company in regard to the Commercial News Department. The meeting resulted in the sale of this department to the Western Union Company, which will hereafter control the "tickers" in Pittsburgh.

Underground Stockholders' Meeting.

At the first annual meeting of the stockholders of the American Sectional Underground Electric Company, held at the West Jersey Hotel, at Camden, N. J., on May 7, President William Johnstone made a verbal report of the year's work of the company. He said that its future depended on the results of the tests of the underground system now being made by competent experts in Chicago. If it shall be found that the conduits answered for all classes of electric conductors the success of the company is assured. In that event the Chicago company has engaged to advance $35,000 in cash, and to contribute $250,000, one-fourth of its capital stock, besides operating the Philadelphia company's patents. Similar negotiations are pending as to the Cleveland and New York companies, so that the only problem is to prove the efficiency of the system. On motion, a committee of three was appointed to prepare a code of by-laws for the government of the stockholders' and directors' meeting. The following directors were elected without opposition: George W. Bratton, Alex. F. Sabine, Joseph C. Herr, Thomas J. Diehl, J. Ensign Fuller, Joseph B. Ecclesine, Jr., William H. Johnstone, William S. Cowper, George R. Thompson. The meeting was adjourned to May 29, at the West Jersey Hotel, when a full report of the tests made in Chicago will be laid before the meeting, and, it is hoped, satisfactory conclusion of the negotiations with the other companies.

The Electric Light in California.

San Francisco has been in darkness for some time, so far as street lights have been concerned. The California Electric Light Company has made a proposition to replace 1,700 gas lamps of 16-candle power, maintained at a cost of $77,350 per annum, with 210 electric lamps, aggregating 420,000-candle power, for the sum of $65,520 per annum. These lights are to be set upon 40-foot poles at the crossings of every alternate street. From private sources it is learned that there is a sentiment largely in favor of the electric light, which will give a much better light for a great deal less money. Oakland is also looking longingly toward this superior illuminant, and the gentlemen from that city who were delegates to the Sunday-school Association examined the works, the power of the illuminant and the extent of territory which the lights covered with a great deal of interest and minuteness. Thus it is likely that the metropolis and Oakland will follow in the footsteps of San Jose and Los Angeles in adopting the light of the nineteenth century, after being bankrupted by the old monopolies and compelled to abide in darkness for a lack of means wherewith to pay for lighting.

AN AMERICAN ELECTRICIAN ABROAD.—Prof. Hugo Walter, formerly of the University of Cincinnati, is now the electrician and one of the managing directors of the Walter Electric Company at Brussels, Belgium.

DEPARTMENT OF INQUIRIES.

18. SUBDIVIDING THE CURRENT.

What is the simplest method in use for dividing the electric current coming from one source of generation to be used in small quantities on a series of separate manufacturing machines.

RAVENNA, Ohio. H. S.

If we make several distinct circuits connecting with a given source of current, the current divides itself through all the branching circuits, just as the water of a river divides itself into smaller streams to go around an island. In electrical circuits the current passing, in consequence of a given electro motive force, always varies with the resistance of the circuit, in inverse proportion. Therefore, if the current divides itself through several branch circuits, the branches with the lowest resistance will receive the greatest share of the current. If it is desirable that the current shall be equally divided between all the branches, then the resistances of all the branch circuits should be made equal, by adding enough artificial resistance to the low resistance lines to make them equal to the lines having the highest resistance. For this purpose the resistance of each branch circuit should be accurately measured. Telegraph lines are frequently connected in this manner so as to form several branches from one pole of a battery, while the other pole connects with a common wire. This is called connecting in "parallel" or "multiple" circuits. The trunk lines of the Western Union, which are all worked by the current of dynamo-electric machines, are connected in multiple circuit in this manner, with compensating resistances to equalize the distribution to each line. The system is described in No. 15 of THE ELECTRICAL WORLD, page 226. The procedure to be adopted in the present case is just the same as in the latter, and depends likewise on the theory given above. The machines should be connected in multiple circuit. If they are all alike and are required to do the same work, the resistance of all the parallel circuits, including that of the machine, of course, should be equal. If the machines all work too fast, resistance should be added to the branch circuits. If only a few need less current, resistance should be added their circuits only. If a few need increased current, their resistance should be diminished, or else the resistance of the others increased. If the machines in question are electro-motors, it will be found that the speed at which they are allowed to run will influence the amount of current passing, as each motor gives rise to a "back pressure," or counter electro-motive force, which will diminish the amount of current passing in its circuit. This counter electro-motive force increases with the speed. Therefore, if the motor is to run at higher speed than the rest, the resistance of the circuit on which it is placed should be lower than that of the rest. Lastly, in distributing current by parallel circuits, the total resistance of all the circuits should always remain the same, that the stoppage of one motor may not affect the other circuits. When the motor is cut out of circuit, an equivalent resistance should be switched in, so that the same amount of current may continue to pass on that branch.

19. ARMATURES AND ELECTRO-MAGNETS.

Is a dynamo with a Siemens armature as efficient as one with a ring? Will not a magnet wound with silver wire be more powerful than one wound with copper wire?

SOUTH BEND, Ind.

If the Siemens armature referred to is one of the old type, called an "H" armature, then we may say a ring armature is preferable. If the Siemens drum armature of recent construction is meant, then we should say that there is not much practical difference, either in the cost or trouble of winding or in efficiency. A magnet wound with silver wire would have a slightly smaller resistance than one wound with copper wire, because the conductivity of silver is about one per cent. better than that of copper. The magnetic power of a magnet depends on the number of turns of its wire coils and the quantity of the current used. If the total resistance in circuit were made the same with a silver wire and a copper wire magnet, the magnetic power would be the same. In this case, in order to make the resistance equal, the resistance of the connecting conductors or of the battery would have to be diminished by the small fraction representing the difference between the silver and copper wire resistances. For instance, if the resistance of the silver wire magnet is 99 ohms and that of the copper wire magnet 100, the resistance of battery and connections being 5 ohms in both cases, then a given electromotive force, say two volts, would produce a current indicated by the fractions $\frac{2}{104}$ and $\frac{2}{105}$ of an ampère, respectively. If, however, the resistance of the connection or battery in the second case is reduced one ohm, then the currents will be both $\frac{2}{104}$ and, the number of turns being equal in both magnets, their magnetic powers will be equal.

[In giving a place to this query in our columns, we have departed somewhat from our custom of requiring the full name and address of correspondents as evidences of good faith. We consider the omission of the name in this instance to have been an oversight, because the letter contained money for copies of THE ELECTRICAL WORLD. We will send our correspondent what he desires as soon as we learn his name.—ED. ELECTRICAL WORLD.]

20. PECULIAR TROUBLE IN A TELEPHONE OFFICE.

I have been troubled considerably since we started in our new office by a leakage from an electric generator run by steam, the particulars of which are as follows: There are three binding posts on a certain desk. Two of these connect with the main lines of transmitter after passing through the telephone and through a loop in the superintendent's office. The other binding post connects with the heel of a switch which, when resting on a stud that connects with a small electric generator run by steam, creates a very disagreeable sound, the noise being so loud that it prevents talking. On examination I could find no trouble apparently, and thought the cords which connect from these posts, being braided together, had become wet from the sweat of the hand or otherwise. In testing to see if this was the cause, I found it was not. I made a cross-examination and found that as the posts were resting on the oil-cloth, with which the desk is covered as desks usually are, they had made an almost perfect connection by means of this covering. This had caused the trouble. On removing the cloth from under that post that connected with the switch, the noise ceased. Now, it must be that there was some chemical in the piece of oil-cloth. I would like to hear if a similar case has been known.

L.

PORTLAND, Me.

This is an interesting case. The trouble was undoubtedly due, as suggested above, to a diversion of the curren by its passage from binding post to binding post throug the material of the oil-cloth. The word insulation, as

well known, is only a relative term. It means simply a poor conductor; all insulators conduct to a certain extent. The conduction of currents in materials of high resistance depends very much on the electromotive force of the current. Thus a lead pencil mark on a piece of paper though ordinarily a non-conductor, can conduct electricity when the electromotive force of the current is increased sufficiently. The paint of the oil-cloth probably contains mineral substances which can similarly conduct currents of rather high electromotive force, such as the electric generators usually produce. By taking out the binding posts and rubbing the woodwork with warmed or melted paraffine the difficulty might be obviated. Paraffine is still better than a coat of shellac, because it is less liable to attract moisture. There is often a film of moisture which covers the surface of an object so thinly that it is not observable, but yet is sufficient to transmit some current. On shellac moisture deposited at one point is more liable to spread than on paraffine, which is of an oily nature and repels water.

21. RAPIDITY OF THE LEGGO AUTOMATIC SYSTEM.

In the Chicago *Times* I find it stated that Rufus Hatch, of New York, who is interested in the Postal Telegraph Company, conducted some experiments recently with the Leggo system adopted by that company, and sent messages from New York to his clerk in Chicago at the rate of one thousand words a minute. Is it a fact that a thousand words a minute can be transmitted by that system, or is this item the product of some reporter's vivid imagination? E. N. R.

CABERY, Ill.

From the officials of the Postal Company we learn that the story is true. The time required for preparing and translating the dispatches is not, of course, included in the minute. They say that by the Gray system they have been enabled to transmit 2,124 average dispatches between New York and Boston in nine hours, with five operators at each end.

THE TELEGRAPH.

THE WESTERN UNION IN LONDON.—A London dispatch says the application for the listing of Western Union at the London exchange has been indefinitely postponed.

DISTRICT TELEGRAPH CONSOLIDATION.—At a special meeting of the stockholders of the Mutual District Messenger Company of Boston, on the 8th inst, it was voted to ratify the contract whereby all the property, lines and franchise of the District Telegraph Company shall be transferred to the Mutual District Messenger Company of Boston. It was also voted to increase the capital stock from $100,000 to $250,000.

DAMAGE TO THE WIRES.—The storms in the West are playing havoc with telegraph wires in that section. A telegram dated Ft. Stevenson, Dak., May 16, says that the storm of the 9th and 10th insts. completely isolated that place from the outside world. The military telegraph lines, both wires and poles, were blown down for miles, and travel was practically suspended, the roads being in such a bad condition.

ANOTHER TELEGRAPH COMPANY.—The certificate of incorporation of the Northern and Southern Telegraph Company was filed in the New York County Clerk's office on the 15th. The lines of the company are to run from this city through New Jersey, Pennsylvania, Delaware, Virginia, North Carolina and South Carolina. The capital stock of the company is $100,000, divided into 1,000 shares of $100 each. The terminus of the line is at Charleston, South Carolina.

NEW DISTRICT COMPANIES.—The "New Haven, Conn., District Messenger Company" is rapidly constructing its lines in New Haven, and the system, which will be soon completed under the supervision of Mr. S. D. Lake, will be one of the most perfect and elegantly equipped in the country. Mr. H. B. Ingram, recently of the Manhattan Co. of New York, is the superintendent. Messrs. Haines Brothers are constructing the new system for the "Hartford District Messenger Co." of Hartford, Ct. The company will be in operation about June 1, and will co-operate with the New England Telephone Company.

A NEW CABLE FOR THE B. & O. TELEGRAPH COMPANY.—The B. & O. Telegraph Company has ordered from Mr. A. G. Day a duplicate set of kerite cables. The large cable of this company across the Narrows will be laid on Saturday next. The kerite cable previously laid by the B. & O. is the largest one ever manufactured in this country, and has proved its efficiency. A tug with a very large schooner and several scows attached were afoul of the first cable across the Narrows some four or five hours on Wednesday of last week, but by reason of the size and strength of the cable, they were unable either to raise or disturb it. This cable is now working perfectly, after having been subjected to so severe a test.

THE TELEPHONE.

CONNECTED BY TELEPHONE.—Saratoga Springs, N. Y. and Stillwater are now connected by telephone.

SOUND ADVICE.—The *New Orleans Picayune* says: "Sound advice that comes by telephone is not to be despised."

MINNESOTA.—Telephone connection has been made between Winona and Red Wing, and verbal messages exchanged which were distinctly audible.

HANDY TO HAVE IN THE FAMILY.—A telephone is a mighty handy thing to have in the family when you want to order something and have not the cheek to ask the man, to his face, to give you more credit.—*New York Star.*

EXCESSIVELY POLITE.—It is said by somebody that the politest man in Des Moines is a gentleman who put a telephone in at his home a few days ago, and who has called the central office up regularly every night since to bid the operators "good night" before retiring.—*Boston Post.*

WHAT MADE THE CENTRAL MAN MAD.—"Hello, Central!" was launched through that means of rapid transit by a Yonkers subscriber about twelve o'clock Sunday morning. "Hello, what's wanted?" responded the man at headquarters. "Please send a messenger to get our hired man out of bed." was shouted back. The phone was hung up with a bang.—*Yonkers Gazette.*

BIRMINGHAM, ALA.—The telephone exchange at Birmingham, Ala., celebrated its first anniversary on the 8th inst. It was organized a year ago, under the management of Mr. C. H. Coyen, with only a few subscribers. It is already a prosperous and growing institution, the largest in the State. Mr. B. D. De Forest is now manager. The number of calls per day averages over 1,800.

PENNSYLVANIA.—At the State Capitol, on May 9, several members of the Legislature, from Montgomery County, were called into the Speaker's room, where telephone connection is had with the Harrisburg Exchange, and were surprised by receiving communications direct from their constituents in Pottstown, telephonic communication having just been established between the two cities. The distance is 72 miles.

THE TELEPHONE IN NEW ENGLAND.—The new system of police telephone in Salem, Massachusetts, had its first practical test on Saturday May 12. Two officers on Derby street attempted to arrest a man, when some 300 roughs attempted to rescue him. An officer telephoned to the station, by the police telephone and in a few minutes the police wagon with a detail of men appeared on the scene and dispersed the crowd.

OVERCOMING INDUCTION.—In St. Louis on the 12th instant the electrical sectional conduit for underground telegraph and other wires for electrical purposes was given another test, and the *Republican* says that all the advantages claimed for it seemed to be sustained, and it appeared as if every properly insulated wire run into the conduit in accordance with the mechanical and electrical details required by the system could be worked without interference, and that induction had been practically eliminated.

THE NORTHWESTERN BELL TELEPHONE COMPANY.—This company, at its annual meeting recently held, elected Mr. Geo. L. Phillips as a director to represent the home interest in the board. The capital stock of the company was also increased to $100,000. The company has put into Clinton, Iowa, Exchange a new 150-line switch-board, enclosed in an elegant solid cherry case, elegantly designed, making that exchange a model one of the kind. The reconstruction of the system is fast nearing completion. Over 60 towns are now connected.

INDUCTION.—The Scranton, Pa., *Republican* tells of a remarkable instance of inductional effects. M had completed his wire line to a point between Shickshinny and Bloomsburg previously agreed upon by the Bloomsburg and Wilkesbarre exchanges. The Bloomsburg line had been brought up to within three miles of the same point, but the two exchanges were found to be communicating with each other over a gap of three miles. The current was carried by induction to the telegraph wire on the same poles, and from these, again, to the telephone wires, thus completing the circuit without any actual connection.

A NEW LONG-DISTANCE TELEPHONE.—The Utica, N. Y. papers chronicle an experiment which took place on Sunday last with a new telephone, the joint invention of Mr. Nathaniel Parks, of Deanville, N. Y.—who has been experimenting with electricity for about forty years—and Mr. Frank J. Callanen, of Utica. The patent has not yet been obtained, and so no description of the instrument can be given. The Utica papers say, however, that in a circuit of five Western Union wires (No. 9 galvanized iron) running between Utica and Albany, making a circuit of about 500 miles of continuous wire, the transmitter worked admirably and was heard distinctly.

ONE OF THE DRAWBACKS TO THE TELEPHONE.—The telephone does sometimes interfere with a man's domestic happiness. Wilkins started to put on his coat the other evening just after supper, thinking to slide down to the nearest drug store for a drink. "Where are you going, my dear?" asked his wife. "Just down street to see a man," answered Wilkins. "But why go way down street this evening, when you can talk to him right from here? He can't be much of a man you are going to see if he doesn't have a telephone." And Wilkins wearily went to the instrument and made a feint of calling up somebody whom he knew wouldn't be in.—*Lowell Citizen.*

THE LOWELL COMPANIES.—The telephone exchanges under Lowell management made additions to their list of subscribers during the month of April as follows:

	Gain.	Con. May 1.
National Bell of Maine	53	3,880
Boston and Northern	136	3,160
Bay State	64	2,589
Granite State	4	423
Suburban	102	1,352
Union	45	330
Northwestern	252	1,520
Total	646	13,204

A "LONG-DISTANCE" STORY.—A Cleveland reporter asked an electrician of that city the all-absorbing question, "What is induction," and in illustrating its effects, the electrician related the following: "A short time since, while experiments were in progress at the Postal Telegraph Company's office, with a view to establishing telephonic communication between this city and New York, an incident happened which serves to illustrate this point. The gentleman conducting the experiments rang the bell, as he supposed, for New York, and cried 'Hello.' After waiting a short time he repeated the exclamation, and was rewarded by a faint 'Hello' in return. 'Is that New York?' asked the gentleman. 'No, this is Mr. ——— of Prospect street.' You see the Postal wire passed near a telephone wire, and induction had carried the 'Hello' to the residence of the Prospect street gentleman.

INJUNCTION.—A dispatch dated from Chicago says that a bill was filed May 16 in the Circuit Court, in that city, by George E. Shaw against the Shaw Telephone Company and Alfred P. Willoughby, to restrain them from using his patents for improvements in telephones. He alleges that in December, 1881, he made an arrangement with Willoughby for the sale of his patents to some company for not less than $200,000, half cash and half in full-paid stock of the company. Willoughby was to have one-half for his trouble. The patents were conveyed to the Shaw Telephone Company, but the complainant has never received anything for them. Recently the company has been trying to sell out to the Globe Telephone Company, of New York, and the complainant charges that if this be allowed he will be defrauded out of his patents. He therefore asks for an injunction and for a decree canceling the transfer to the Shaw Telephone Company. The injunction was issued under a bond of $3,000.

PROVIDENCE TELEPHONE COMPANY'S REPORT.—The Providence Telephone Company has under consideration the question of increasing its capital to $200,000. The annual report shows that during the past year 320 miles of wire have been put up, or more than 20 per cent. of the entire mileage. It has 2,403 instruments in use. The company has experimented with the underground system of wires, but without success. Hon. Henry Howard told the stockholders at the annual meeting that there were some 350 patents taken out for underground systems, not one of which would be equal to the doing of a practical telephone business. It is simply a matter of investigation and scientific research. At present, it is far better to leave the wires as they are. It is not the expense, but the impracticability of the underground system, which makes it at present objectionable. The future telephone system will, without doubt, be the aerial. An important question has arisen since the last meeting, ralative to demands made by the American Bell Telephone Company, the directors having decided it impracticable to meet the same.

THE AMERICAN BELL TELEPHONE CHARTER.—In the Massachusetts House of Representatives, on May 8, when the bill was reached to change the charter of the American Bell Telephone Company so as to allow it to hold more than 30 per cent. of the capital of corporations operating under license from it and of the capital of corporations in Massachusetts engaged solely in the manufacture of electrical instruments, Mr. Mackintosh, of Dedham, moved to amend by excepting the first class of corporations. He said the bill was an attempt of the American Bell Telephone Company to get control of the Bay State Telephone Company. His amendment was opposed by Messrs. Starbird of Lowell, Hill of Haverhill, Hartwell of Fitchburg, and Moriarty of Worcester, who said that, under the present law it is possible for the Western Union Telegraph Company, to which the Bell Telephone Company promises to become an active rival, to prevent the telephone company from establishing long lines and doing a competing business. By a large vote the amendment was rejected and the bill passed to be engrossed, thus completing its passage of the two houses.

THE MONKEY AND THE TELEPHONE.—The Baltimore *Sun* is responsible for the following: "Jocko, an intelligent monkey belonging to Dr. W. H. Crim, is possessed of more curiosity than can always be safely indulged. One day last week he carried his investigations into the working of the telephone further than was well for him. After watching with apparent interest the Doctor at the telephone, and listening to his shouts of 'Hello—what? Hello, Central!' Jocko started out to learn where the sounds went to and who was at the other end of the line. Following the wire up the side of the house to the roof, Jocko looked about him in vain for an outlet for the sounds which the Doctor could easily be heard uttering in the office below. Jocko seized the wire, and, winding his intelligent tail about a parallel line, he started out in search of the other end. Just at that moment either a heavy current of electricity passed through the wire and shocked him or the vibrations of the Doctor's voice shook him off, and he fell forty feet to the ground below, breaking his leg. He was carried into the Doctor's office and tenderly cared for, the broken bone being set. Jocko now goes about with an injured air, but he is likely to recover."

THE ELECTRIC LIGHT.

A TOWER BLOWN DOWN.—A terrible wind-storm passed over Fairfield, Ia., May 9, and blew down the electric tower, completely demolishing it. It was an Elgin tower, 175 feet high, had six Brush lamps on it of 2,000 candle-power each. The lamps are a total wreck. The tower fell across the Western Union Telegraph wires, tearing them down for a quarter of a mile.

READING.—The Reading, Pa., Electric Light Company is pushing its work ahead rapidly. It expects to light the city within thirty days. Mr. O. W. Stager, superintendent of the P., R. & P. Telegraph Company, has connected himself with this company in the capacity of electrician. It is said he will soon resign his superintendency to devote all his time to the work of electric lighting in this territory. The electric light has been improved since Mr. Stager has been in charge.

CHARGED WITH EMBEZZLEMENT.—The New York *World* of the 12th inst. says: Frank S. Harding, treasurer of the Edison Electric and Illuminating Company, was complainant at Jefferson Market yesterday against Hiram L. Tracey, of No. 22 West Fifteenth street. Tracey has been bookkeeper and collector for the company, and it is charged that he has only accounted for a part of the money collected. He was held for trial on one complaint charging him with embezzling $10, although it was said that the sum will amount to hundreds.

LIGHTING THE BRIDGE.—The United States Electric Lighting Company has completed arrangements for lighting the Brooklyn bridge. Seventy lamps are in place and the circuits are ready for the current. The United States Company furnish the engines for running the dynamo machines, and the bridge people were to furnish the steam-power for the engines. As the boilers are not ready the United States Company will be obliged to obtain the current from its Stanton street station.

THE ELECTRIC LIGHT AT THE CORONATION OF THE CZAR.—The Russian papers state that the electric light will play an important part in the decorations at Moscow on the occasion of the czar's coronation. During four nights the citadel of Kremlin will be illuminated in a dazzling manner, with no less than 4,000 Swan incandescent lights and 120 arc lights. The Moscow municipality has voted a sum of 80,000 roubles ($64,000) for the illuminations which will be made in various parts of the city, such as the Grand Hotel, Red square and Sokolnikifaree place.

ELECTRIC LIGHTS ON FERRY BOATS.—The order of the United States Steamboat Inspectors that the gasometers on ferry boats be removed from the holds of those vessels will propably lead, or at any rate ought to lead, to the introduction of electric lights on these vessels. Some of the excursion steamers already use this light, and as they all have the motive power for generating the electricity, it must be cheaper than gas, as well as a much safer and far more brilliant method of illumination. At the time of the Westfield explosion, in 1871, the *Tribune* exposed the dangerous character of the gas-tanks on board the ferry boats, and some precautionary measures were taken by the companies to guard against the consequences of leaks. But the present order which makes necessary a change in the tanks ought to effect their entire disappearance.—*N. Y. Tribune.*

CHANGES ITS NAME.—In order to avoid complications likely to arise from similarity of names, the directors of the American Electric Company, of New Britain, Conn., by a special act of the Legislature have changed the name of that company to the Thomson-Houston Electric Company. We learn from the company that local companie

using this system have been organized in Boston, Lowell, Fitchburg, Fall River, Lynn, Salem, Haverhill, Woonsocket, Hartford, Utica, Peoria and Kansas City, and arrangements for similar companies are in progress in various other towns. The system is also meeting with favor in factory lighting. The Thompson-Houston Electric Company is now controlled by capitalists of Eastern Massachusetts, and though its works are still at New Britain, the principal business office has been established at Boston. Before many months the dynamo-machines and lamps will be manufactured in a large new factory now building at Lynn.

ELECTRIC LIGHTS IN THE STOCK EXCHANGE.—On the 12th inst. workmen began placing the Edison electric light in the board room of the Stock Exchange in this city. Three chandeliers, each having sixty-six lamps, have been suspended from the ceiling. The two circles of lamps in each one will be operated on different circuits, so that they may be used independently. On Tuesday, 15th, after the close of business, the lamps were lighted for the first time. The exhibition attracted many members of the exchange, because it was understood that the use of electric lights in the building depended upon the success of the experiment. Several officers and large stockholders of the Edison Company were present. The room had been darkened by closing the heavy iron shutters of the doors and windows. The levers of the switch-board were touched, and immediately the three clusters of lamps hanging from the ceiling glowed with light. At first many of the spectators were disappointed that the illumination was not more brilliant. After becoming accustomed to it, they expressed great satisfaction. The power used was 16-candle, but it is intended to increase it to 20-candle.

THE SHOCK FROM A WESTON MACHINE.—A short time since one of the line-men employed by the Citizens Electric Light Company, of Toledo, O., which is running a central station supplying something over one hundred Weston arc-lights, received a shock from two twenty-light machines coupled together and supplying a forty-light circuit. He was making some change in the adjustment of one of the lamps, and took it out of circuit just before the time for starting up in the evening. Before he placed it in position again the current had been turned on without his knowledge, and he accidently took hold of both terminals of the circuit and received the current from the two machines. The shock was so severe as to close his hands on the wires, and he fell from the step-ladder on which he was standing, his weight tearing him from the wires. His hands were somewhat burned, but he did not lose an hour's time from his work, and suffered no other injury or inconvenince. This shows the comparatively safe nature of the continuous current, as compared with the intermittent or undulatory current, which is used in some of the systems. A similar accident occurred in Boston a short time since, in which a line-man, under the same circumstances, suffered a shock from five ten-light machines coupled without receiving any injury.

MISCELLANEOUS NOTES.

INCORPORATED.—At Columbus, May 10, the American Union Electric Company, of Cincinnati, capital stock, $100,000.

THE HAY STACK SUPPLANTED.—Beside an oil tank the hay stack, once dearly beloved of lightning, loses all its old time attractiveness.

ELECTRIC RAILROAD SIGNALS.—In the Massachusetts Legislature, on May 8, a resolution was reported from the Railroad Committee instructing railroad commissioners to investigate the subject of electric and other signals for the protection of grade crossings, and to report to the railroad corporations and to the next Legislature.

A NEW MOTOR.—A small motor has been on exhibition at the office of the Edison Electric Light Coupany in this city recently, which supplies sufficient power to run a small sewing machine by simply attaching a wire to take the current supplied to one ordinary burner. It is estimated that such power can be supplied for a cent a day. Similar motors could be used to run light lathes or other machinery not requiring much power.

AFRAID OF THUNDER.—A little twelve-year-old girl in Knoxville, Iowa, was frightened to death by a severe thunder-storm a few nights ago. She awoke during the storm and besought her mother to take her to her bed, "for she was afraid of thunder." Her supplications were unheeded, and soon the mother was aroused by the child's difficult breathing. Approaching the bed with a light, she found her in a dying condition, and in a few moments she breathed her last.

FLORIDA LIGHTNING.—Among the regular weekly consignment of spring lies by gifted liars, published in a journal of this city, we find this modest story credited to Ananias: "Lightning struck a Florida man the other day in the side, ran down his leg to the knee, forked and burned two streaks to the sole of his foot. After leaving him, it hunted up a can of powder, which it exploded, and then knocked a sick man out of bed. The latter found himself cured of the chills when he recovered from the surprise, and the other fellow is none the worse for the lightning trick. The house, however, is a total wreck from the powder explosion."

THE "OLD ELECTRIC GOSPEL."—In his last sermon Mr. Talmage made an application of electricity to religion in these words: Within our time we have had telegraphic invention, telephonic invention and electric light, but all born of old electricity, that element which philosophers have long known, applied to new uses. So we have the same old electric gospel and only new ways of flashing it upon the eyes and the ears and the souls of the human race. Telephonic medium, through which the deaf are made to hear. Telegraphic medium, through which dart invitations and warning to all nations. Electric light, which shall yet illuminate the Eastern and Western hemispheres.

ELECTRIC MOTORS FOR RAILROADS.—At a meeting of the officers and directors of the Electric Railway Company, of the United States—the incorporation of which was chronicled in our last issue—held in this city May 16, it was stated that the company had now business before it which it would take four months time to attend to. It was also reported to the meeting that the arrangements for a track at the Chicago Exhibition of Railroad Appliances, to be held on June 24, had been completed. On this track, which is a third of a mile in length and runs around the gallery of the exposition building, two cars will be placed, capable of seating 60 persons, and fitted with the electric motor and necessary appliances, as well as the station and platform. Mr. Stephen D. Field, the electrician of the company, will take possession of the road at Menlo Park at once, and in a short time the motors will be in use at this place.

STOCK QUOTATIONS.—Telegraph, telephone and electric light stocks were quoted on Wednesday of last week and Wednesday of this week as follows:

	May 9.	May 16.
Western Union Telegraph	83⅝	82¼
Mutual Union Telegraph	20	19⅝
American Cable	69¼	67¾
American District Telegraph	....	....
Edison Illuminating Co	....	60
Edison Electric Light Co	305	325
Parker Electric Manufacturing Co	212	....
N. J. & Long Island Telephone Co	....	99
Overland Telephone	....	....
Underground Electric Cable	55	60
U. S. Electric Light	127	....
Shaw Telephone	39	....
Bay State Telephone	125	....
Brush Electric Illuminating	95	....
American Electric Light	7	....
Edison Isolated	....	160
Commercial Telegram	....	110
Eastern Overland Telephone & T	....	26
People's Telephone	....	20
Union Telegraph and Telephone	....	110
Granite State Telephone	....	92¾
Mexican Telephone	2⅛	2⅞
Tropical Telephone	2¾	2⅛
American Bell Telephone	228¼	238
Northern Telephone	145	151½

THE CHICAGO SCANDAL.—Great indignation prevailed in business circles in Chicago, last week, over the outrageous action of the Council of that city in giving to a hitherto unheard of, and palpably "jobbing" corporation, the exclusive right to erect telegraph poles in the city. The ordinance was vetoed by the mayor on the 11th inst., and at present matters remain *in statu quo*, the telegraph and telephone companies having procured injunctions restraining the city officials from interfering with their wires. The Chicago *Times* of the 13th inst. says: "There is more than a bare likelihood that at the next meeting of the Council a new ordinance granting a short-pole franchise to the now notorious District Telegraph Company will be introduced, embodying the recommendations of the Mayor contained in his veto. Ald. Cullerton yesterday said that such a thing certainly would be done. Ald. Wetherell was of the opinion that it might be well to pass a general ordinance permitting all the existing telegraph companies enjoying the right of way in the city to adopt the aerial cable system as a transient measure, but that it would not be good policy to charter a new company for the purpose of building aerial cable lines, the use of which would at best be only optional with the old companies. Such a grant would only complicate matters. That the friends of the District Telegraph Company would renew their fight seemed to him more than probable, since that part of the revised ordinance relating to the telegraphs gave them the finest chance in the world to do so."

BUSINESS NOTICES.

Never put off until to-morrow what should be done to-day. In other words, spend two minutes to-day and procure a membership in THE UNITED STATES MUTUAL ACCIDENT ASSOCIATION, 320 and 322 Broadway, New York, that you will not regret to-morrow. Send for circular and application blank.

The advertisement of the Electrical Supply Company, in this issue, is a novelty in its way. The company is getting fairly settled in its new quarters at No. 17 Dey street, and by printing the advertisement in colors is able to give readers of THE ELECTRICAL WORLD a *fac simile* of the labels on the carbons it manufactures.

The attention of persons interested in local telegraph and telephone organizations is respectfully called to the electric lighting system of THE FULLER ELECTRICAL COMPANY, and the practicability of making arrangements with that company for the introduction of its apparatus, either in isolated plants or through the formation of local companies desiring to engage in the business of electric lighting. The specially valuable features of this company's system may be seen by examination of its apparatus in Boston, Worcester, Providence, New York City, Brooklyn, Jersey City, Paterson, Philadelphia, Hartford, Lancaster, Scranton, Syracuse, Rochester, Buffalo, Pittsburgh, Wheeling, Steubenville, Xenia, Dayton, Grand Rapids, Chicago, Springfield, Belleville, St. Louis, St. Paul, and many other smaller places throughout the country. Correspondence is invited.

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44 East 14th street, New York City.

ELECTRICAL PATENTS ISSUED

And Dated May 8, 1883.

Armature for dynamo-electric machines; Leo Daft, Greenville, N. J.	277,119
Automatic telegraph; J. Harris Rogers, Washington, D. C.	277,349
Circuit instrument for electric railway signals; Jos. Weis, Jersey City, N. J.	277,390
Device for lighting gas by electricity; John B. Odell, Chicago, Ill.	277,053
Dynamo-electric machine; Joseph A. I. Craig, Montreal, Quebec, Canada	277,237, 277,238
Electric fire-alarm box; Bernard Frese, Chicago, Ill	277,020
Electric divining rod; Cromwell F. Varley, Bexley Heath, County of Kent, England	277,087
Electrical device for winding clocks; George F. Ballou, Waltham, Mass.	377,104
Electric arc lamp; Alfred Shedlock, Brooklyn, N. Y.	277,166-7
Electric lamp holder; Alfred Shedlock, Brooklyn, N. Y.	277,168
Electro-plated insulated conductor of electricity; Nathan H. Edgerton, Philadelphia, Pa.	277,248
Electric annunciator and communicating apparatus; Willam Humans, Cambridgeport, Mass	277,286
Electric signaling apparatus for railway trains; Fred. A. Shaw and Henry E. Judkins, Portland, Me.	277,374
Electrical conductor; Samuel D. Strohm, Philadelphia, Pa.	277,374
Hood for electric lamps; Samuel H. Tacy, New York	277,377
Insulated Electrical Conductor; Willoughby Smith, Wharf Road, City Road, County of Middlesex, England	277,366
Magneto-electric machine; Charles A. Seely, New York.	277,069
Magnetic speed indicator; Edward Ikston, Newark, N. J.	277,179
Receiving-telephone; Myron L. Baxter, Aurora, Ill.	277,199
Splice for telegraph cables; William R. Patterson, Chicago, Ill.	277,335
Transmitting-telephone; Myron L. Baxter, Aurora, Ill.	277,198
Telephone; Henry Clay, Philadelphia, Pa.	277,112
Underground electric conductor or cable; J. Burrows Hyde, New York, N. Y.	277,036

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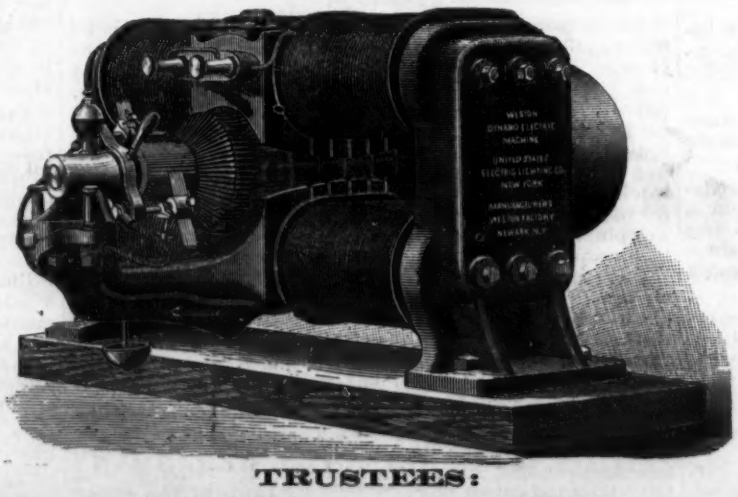

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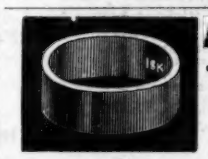

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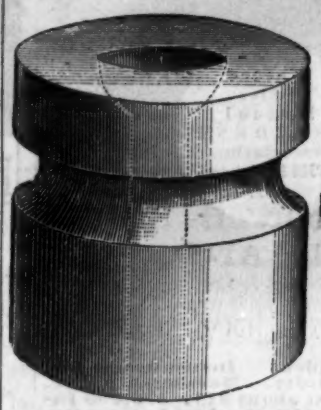

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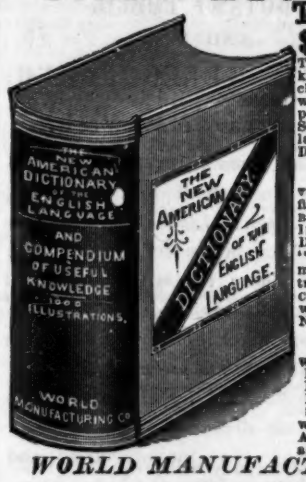
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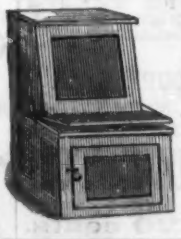

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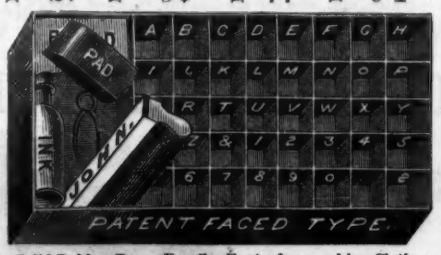

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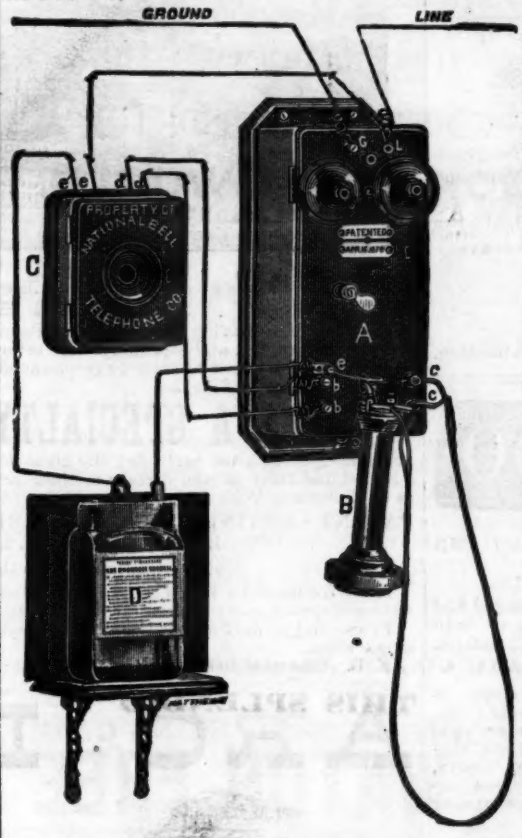

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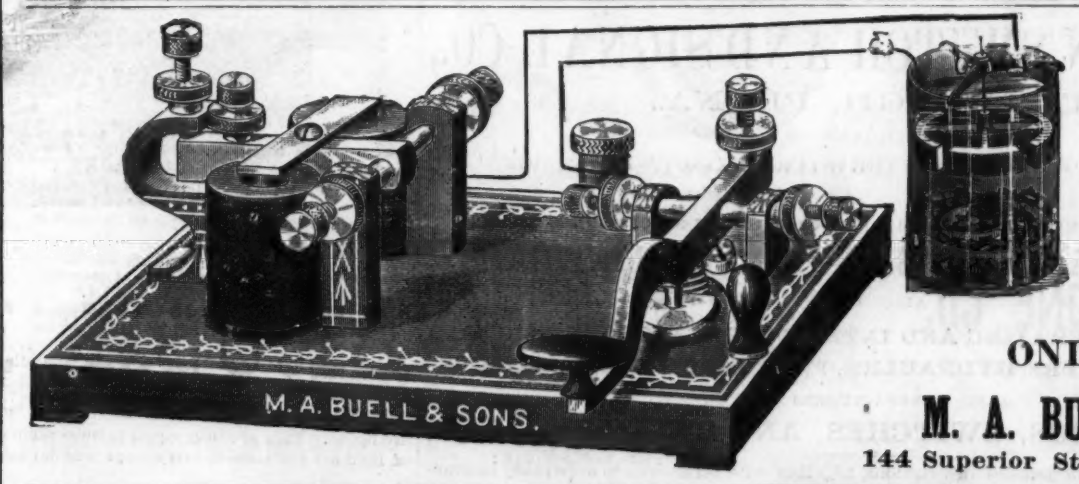

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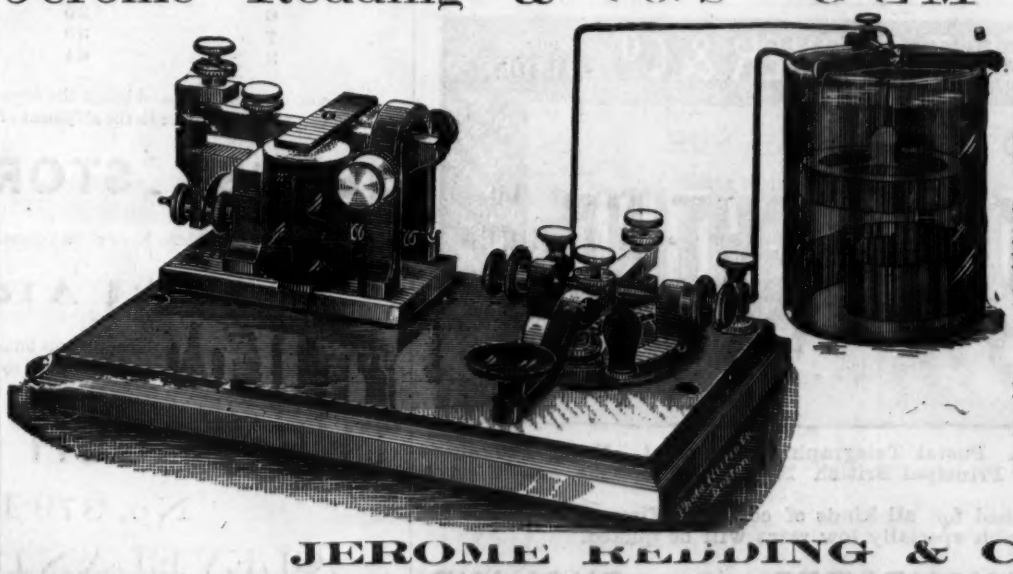

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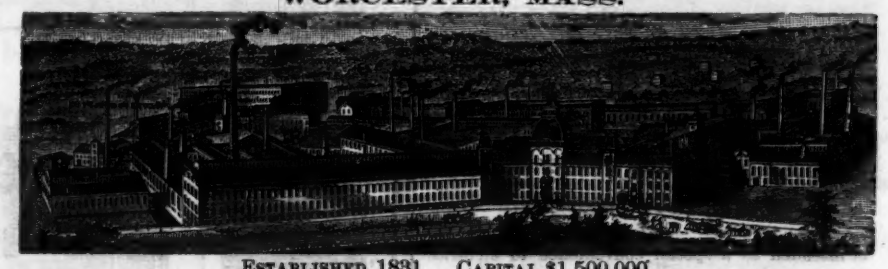

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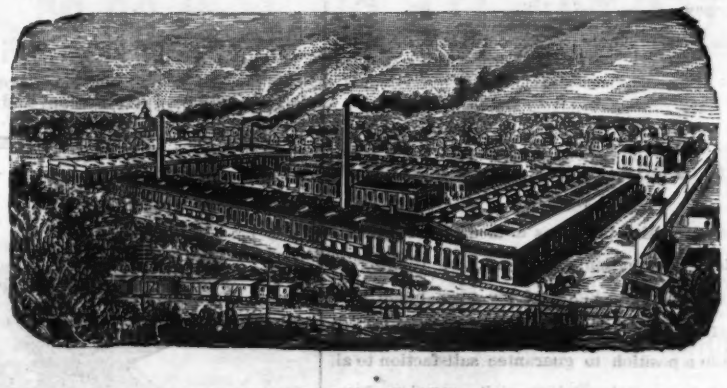

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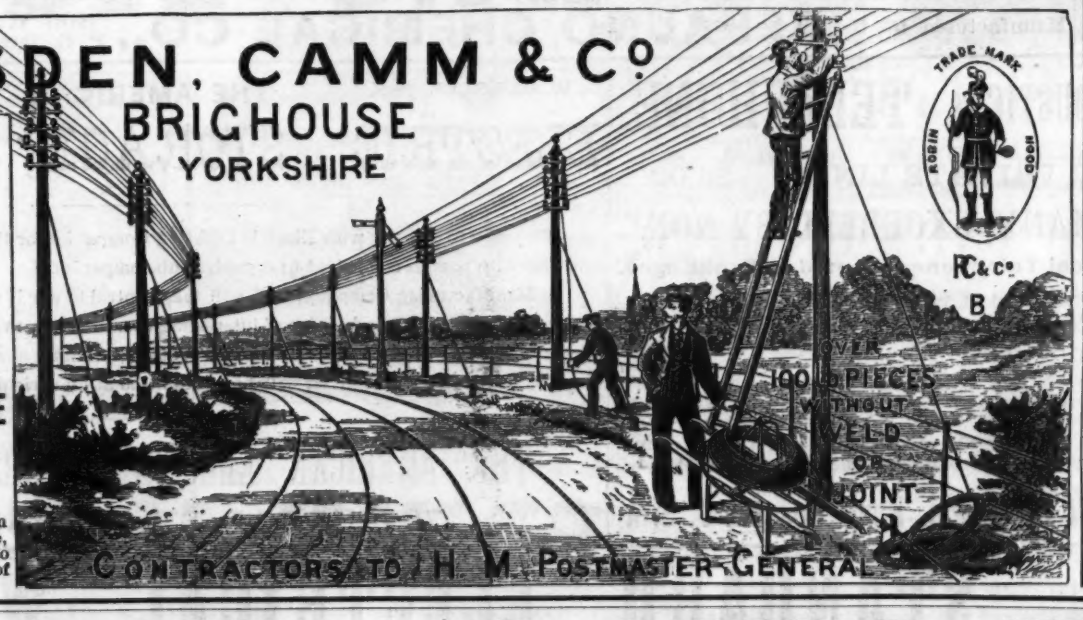

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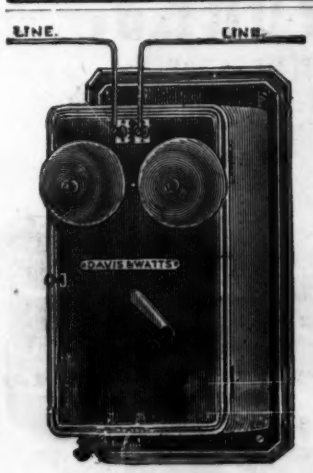

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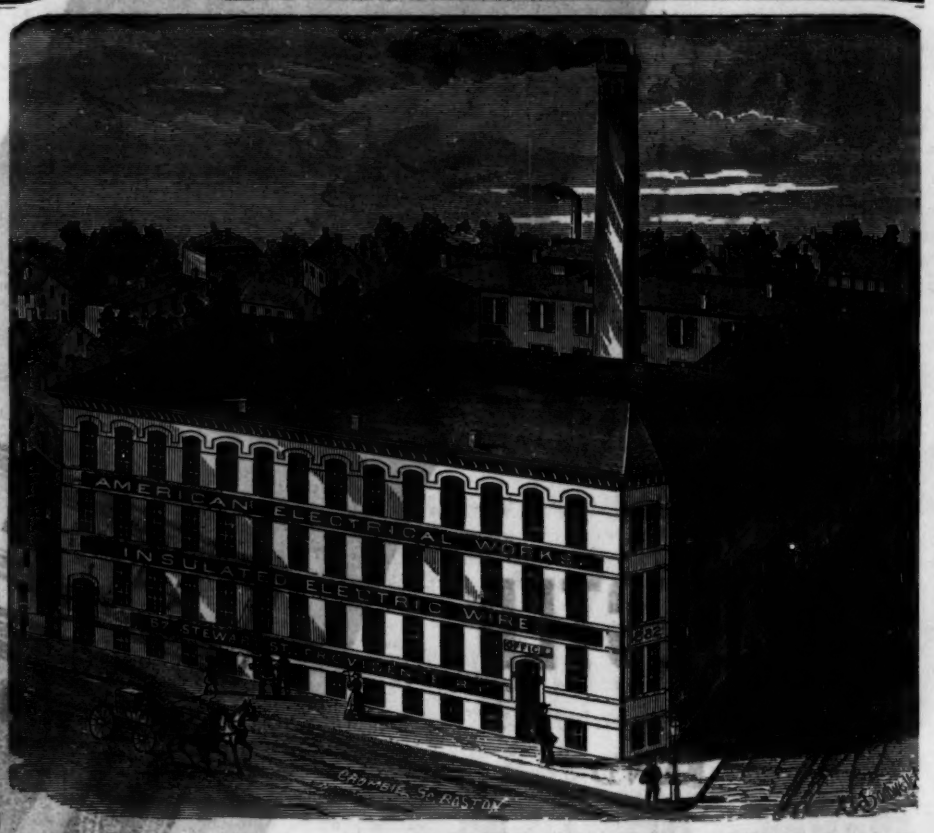

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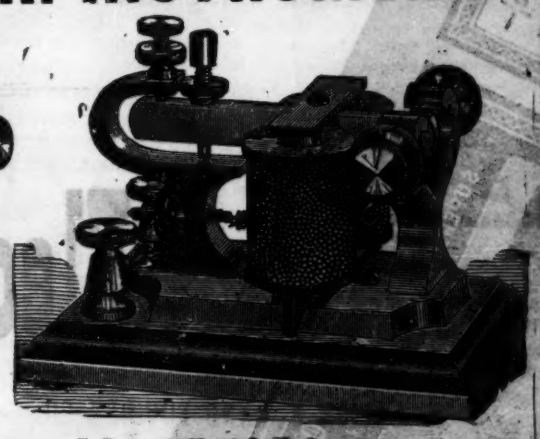

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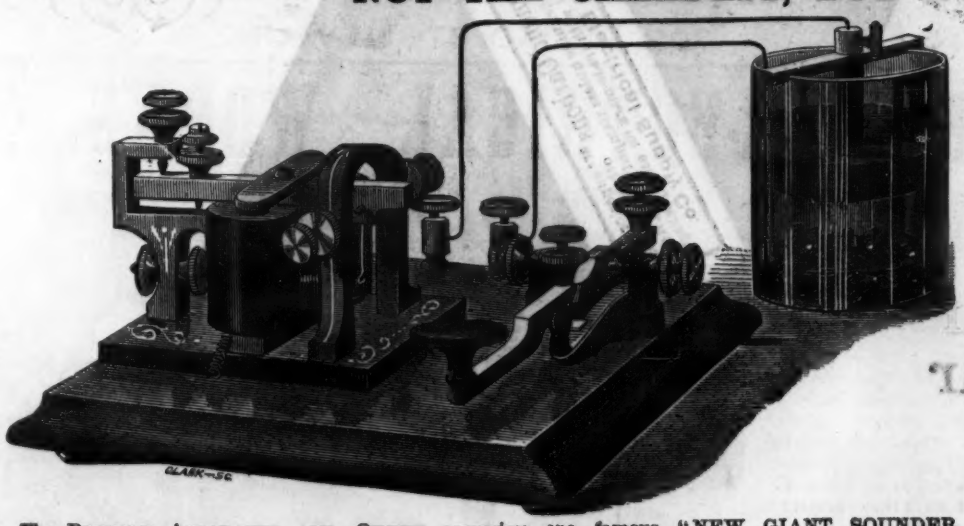

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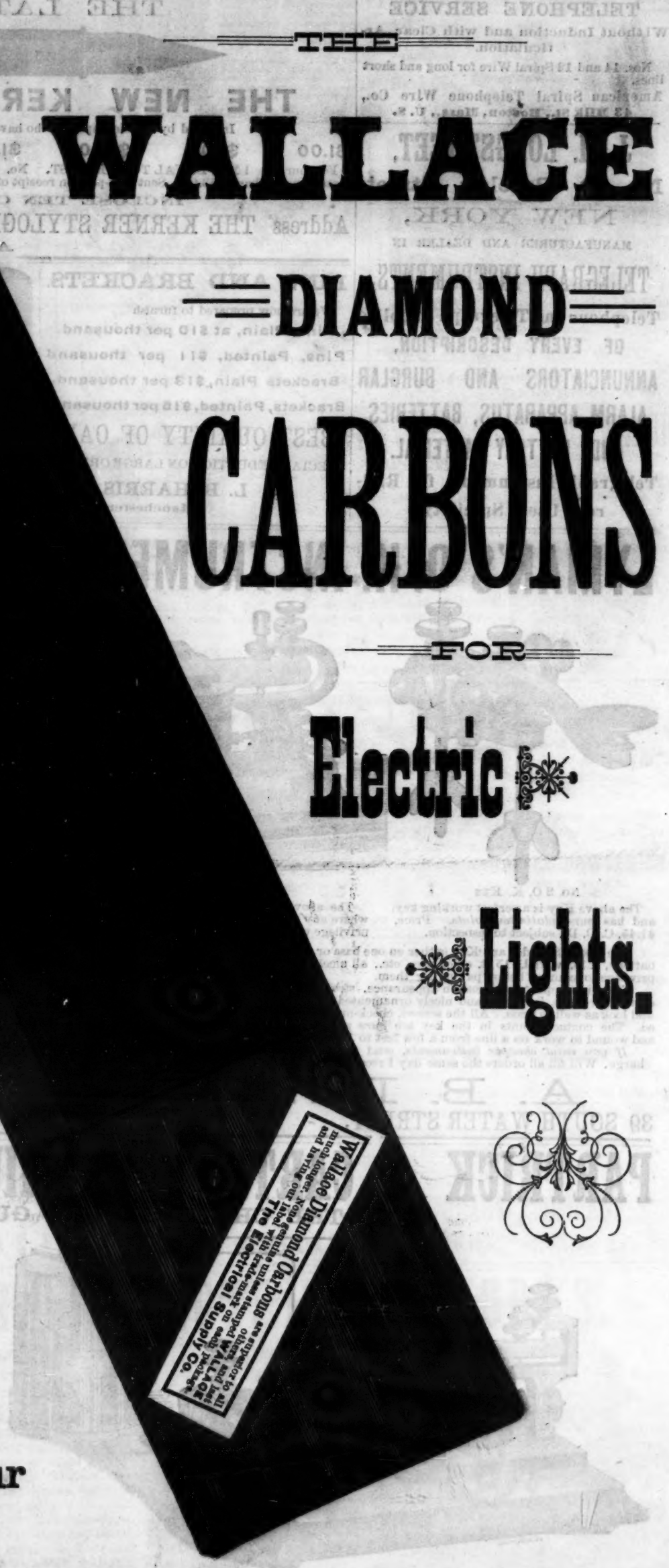

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